Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

ICE AND REFRIGERATION

ILLUSTRATED

Vol I
Nos. 1 to 6

July to Dec.
1891

H. S. RICH & Co.
PUBLISHERS
CHICAGO &
NEW
YORK.



LIBRARY
U.S. DEPARTMENT
OF AGRICULTURE

111542

INDEX.

VOL. 1. JULY–DECEMBER. 1891.

INDEX TO ADVERTISERS.

A

PAGE.

Ainsley, Cochran & Co..46, 108, 168, 232, 300, 368
Alaska Refrigerator Co., The..... 352
American Ice Machine Co. of New York, The..... 47, 109, 169, 233, 301, 369
Armstrong Mfg. Co.....228, 293, 359

B

Baragwanath, Wm., & Son. 356
Bird, F. W. & Son..... 292, 358
Black, A. W..... 294, 317
Blymyer Ice Machine Co., ... 41, 103, 163, 235, 302, 370
Bodenstein, Henry.....226, 288, 354
Bodenstein, J. G. & Co.....223, 289, 355
Brandt, Randolph. 45, 105, 165, 225, 289, 355
Briggs, John N... .....222, 288, 354
Buffalo Refrigerating Machine Co., ... 48, 110, 170, 234, 296, 364

C

Canton Steel Roofing Co., The.....222, 290, 356
Cardell, James D. & Co....2, 64, 124, 184, 247, 363
Case Refrigerating Machine Co., The. 298, 366
Castle Ice Machinery Co..... 229, 298, 366
Central Ice Co., The.....41, 104, 164, 224, 288, 354
Chapman Valve Mfg. Co., ... 5, 67, 127, 187, 287, 361
Clapp, B. P., Ammonia Co., ...5, 67, 127, 187, 251, 319
Cleveland Anhydrous Ammonia Works, The..... 5, 67, 127, 187, 251, 319
Columbus Iron Works Co., ...47, 110, 170, 234, 296, 364
Cook, A. D 7, 69, 129, 189, 253, 321
Cook, E. H., Co.... ..... 287, 353
Craft, James B... ..... 48, 107, 167
Craft Refrigerating Machine Co...231, 299, 367
Crane Co..... 162, 226, 287, 353
Curtis, J. Walton.....42, 104, 164, 224, 288, 354

D

Davis & Rankin Bldg. and Mfg. Co..... 360
Dean Bros.....6, 68, 128, 188, 252, 320
Deane Steam Pump Co., The, ...7, 69, 129, 189, 253, 321
De La Vergne Refrigerating Machine Co., ...52, 114, 174, 238, 306, 374
Directory of Ice Factories, Ice Dealers and Cold Storage Houses, 42, 104, 164, 224, 288, 354
Draper Mfg. Co., The 43, 102, 162

E

Edson, Jarvis B..... 360
Electric Pipe Bending Co..... .... 228, 250, 363
Epping, Carpenter & Co., ... 7, 69, 129, 189, 253, 321
Excelsior Ice and Cold Storage Co., ...42, 104, 164, 224, 288, 354

F

Featherstone's Sons, John.....305, 373
Fleming, The P. Co..... 43, 105, 165
Forest City Packing Co.....225, 289, 355
Foster Pump Works..... 7, 69, 129, 189, 253, 321
Frick Co., 54, 55, 116, 117, 176, 177, 240, 241, 309, 310, 376, 377

G

PAGE.

Galigher, F. L..... ..... 287, 353
Garlock Packing Co., The, 44, 104, 164, 224, 289, 355
Gem City Ice Co..... 162
Georgia Ice Co..... 42, 104, 164, 224, 288, 354
Gerlach, Peter, & Co.....222, 288, 354
Gifford Bros.....42, 108, 164, 224, 288, 354
Goodrich, The B. F., Co.....228, 292, 360
Gordon Steam Pump Co., The..... 316
Grand Rapids Refrigerator Co., The..... 352

H

Harrisburg Pipe Bending Co., Ltd., ... 2, 65, 125, 185, 249, 362
Heerdegen & Schnee... 45, 106, 166, 227, 291, 357
Hercules Iron Works..... 1, 63, 123, 183, 247, 315
Hendrick Mfg. Co., Ltd... ..... 229, 298, 366
Hilpert & Chandler..... 102, 162, 226, 292, 358
Herf & Frerichs Chemical Co., ... 8, 70, 130, 190, 254, 322
Hoppes Mfg. Co., The..... 4, 66, 126, 186, 295, 361

I

Isbell-Porter Co..... 49, 111, 171, 230, 297, 365

J

Jewell, O. H., Filter Co.. ..... 286, 352
Johnson, McCarthy & Johnson, 162, 231, 299, 367

K

Kendall, Edward & Sons, 45, 104, 165, 225, 290, 359
Keystone Chemical Co.. 44, 106, 166, 227, 291, 357
Koenigsberg, Jos..... 199
Krausch Co., The Theodore..... 229, 297, 365
Krebs, H. J..... 50, 112, 172, 236, 304, 372
Kiechler Mfg. Co., The, 44, 106, 166, 227, 291, 357

L

Laidlaw & Dunn Co., The, 6, 68, 128, 188, 252, 320
Lansing Iron and Engine Works, ... 42, 104, 164, 224, 293, 359
Lawson, Enoch..... 42, 104, 165, 225, 290, 359
Louisville Pipe Bending Co., ...3, 65, 125, 185, 249, 361

M

McCarthy & Son, James, 42, 104, 164, 224, 288, 354
McCray Refrigerator and Cold Storage Co., ... 223, 294, 316
Mackolite Plaster Board Co..... ..... 286, 353
Maritzen, Aug..... 223, 295, 318
Mason Regulator Co..... 223, 287, 360
Morris, Tasker & Co..... 3
Moyer, J. W..... 293, 359
Mustard, J. C..... 50, 112, 172, 236, 304, 372

N

National Ammonia Co., The, ... 5, 67, 127, 187, 251, 319
New Orleans Ice Mfg. Co., ... 42, 104, 164, 224, 288, 354
New York Coal Tar Chemical Co., ... 4, 66, 126, 186, 250, 318
Northern Refrigerator Co., The..... 352
Northwest Cold Storage and Ice Co., ... 42, 104, 164, 224, 288, 354
Nubian Iron Enamel Co., The 353

O

PAGE.

Otto Gas Engine Works, 43, 106, 166, 227, 291, 357

P

Page & Tolkacz..... 356
Pennsylvania Iron Works Co., ... 48, 107, 167, 231, 299, 367
Pictet Ice Works, The.. 42, 104, 164, 224, 288, 354
Pontifex Ice Machine Co., The..... 229, 298, 366
Pusey, Lea..... ..... 287, 362

Q

Queen City Omnibus and Wagon Mfg. Co., ... 45, 105, 165, 225, 292, 358

R

Reliance Gauge Co., The, 45, 64, 124, 184, 293, 360
Richmond Ice Machine Co., The, 49, 111, 171, 230

S

Samson Forge Co 248, 362
Sauls Bros..... 45, 107, 167, 219, 290, 356
Seibel-Suessdorf C. & I. Mfg. Co., ... 42, 107, 167, 226, 290, 356
Severn & Caven..... ..... 251, 319
Smith & Vaile Co., The..... 316
Southern Ice Machine Co., ... 56, 113, 173, 237, 303, 371
Standard Ice Co..... 42, 104, 164, 224, 288, 354
Standard Paint Co..... 328
Standard Thermometer Co., 6, 43, 68, 102, 128, 162, 188, 226, 252, 290, 320, 356
Stilwell & Bierce Mfg. Co., ... 43, 105, 165, 225, 289, 355
Stromberg, Allen & Co.... 108, 165, 225, 289, 355
Swanitz, A. W..... 43, 105, 165, 225, 290, 353

U

U. S. Mineral Wool Co. ... 102, 162, 226, 292, 358

V

Valley Pump Co..... 6, 68, 128, 188, 252, 320
Van Winkle Gin and Machinery Co., ... 46, 109, 169, 233, 301, 369
Vulcan Iron Works, The... 45, 107, 231, 299, 367

W

Wainwright Mfg. Co., of Mass., The, ... 3, 65, 124, 185, 249, 317
Washington Market Co., The, ... 42, 104, 164, 224, 288, 354
Watson, H. F., Co..... 228, 292, 358
Weisel & Vilter Mfg. Co., The, ... 46, 109, 169, 233, 301, 369
Weiskopf, A..... ..... 102, 162, 226, 290, 356
Western Ice Machine Co... 105, 168, 232, 300, 368
Western Mineral Wool Co.. 64, 124, 184, 292, 358
Whitehall Engine and Pictet Ice Machine Co..... 51, 115, 175, 239, 307, 375
Wilson-Snyder Co., The, ... 51, 118, 178, 242, 311, 378
Wingate & Mell..... 45, 107, 167, 231, 290, 356
Wolf, Otto C.....Inside Front Cover
Wolf, The Fred W. Co.... 8, 70, 130, 190, 254, 322
Wood, Wm. T., & Co..... 162, 226, 288, 354
Woolford, Geo..... 5, 67, 127, 187, 251, 319

Y

York Mfg. Co.....Inside of Back Cover

OCT 24 1910

INDEX TO LITERARY CONTENTS.

HEADINGS OF DEPARTMENTS.

PAGE.

Answers to Correspondents, ... 27, 90, 149, 208, 270, 339
Artificial Refrigeration..... 12, 91, 141, 260, 327
Cold Storage..... 29, 96, 136, 210, 279, 347
Engineering and Architecture..... 193, 264, 331
Ice and Refrigerating Mach'ry,..33, 81, 154, 201
Ice Making..... 18, 73, 156, 197, 276, 341
Ice Trade Notes—Natural Ice, ... 17, 99, 145, 209, 272, 344
Insulation..... 35, 151, 156
New Ice Factories..... 19, 76, 159, 198, 277, 342
New Patents..... 38, 100, 161, 220, 285, 351
Official Notices..... 148
Packing House Refrigeration, ... 32, 80, 149, 204, 273, 350
Railway and Steamship Refrigeration, ... 133, 213, 274
Trade Correspondence..... 146, 199, 278, 336

TITLES OF ARTICLES.

WITH AUTHORS' NAMES.

A

Abandoned Projects 77
Accidents..... 37
Advertising, Novel..... 98
Air, Bacteriological Examination of. *Prof. J. E. Siebel*..... 208
Ammonia Drum Explosions, To Avoid..... 75
Gas, Pressure of 340
A Novel Ice Making Plant..... 341
Apparatus, Refrigerating..... 154
Army Posts, Ice Machines at..... 196
Artesian Wells, Shooting..... 333
Artificial Refrigeration, *Auguste J. Rossi, B. S., C. E.*..... 12, 91, 141, 191, 260, 327
Artificial Refrigeration, Distillery..... 144
Association, South-West Ice Manufacturers'..... 131
Texas Ice Manufacturers' 71
Atmospheric Conditions and Bacteriological Infection. *Prof. J. E. Siebel*..... 195

B

Bacteriological Examination of Air. *Prof. J. E. Siebel.* 208
Bacteriological Infection, Atmospheric Conditions and. *Prof. J. E. Siebel*.... 195
Bending, Electric Pipe..... 259
Bigelow, Ex.-Gov. Hobart B., deceased..... 325
Books, New..... 148, 192, 259
Boston, Dressing Poultry for 345
Boyle, The Late David..... 24
Brine, Preparation of..... 276
Building, Suggestions for..... 267

C

Cincinnati, Ice Making in..... 78
Circulation: Relation to Temperature, etc. *John E. Starr, M. E.*..... 323
Cold Fun..... 102
Cold Storage and the Farm. 96, 210
Holding Eggs in. *D. B. Beemer*... 136, 211
Holding Eggs in..... 349
House, A Model..... 31
Plant at Hot Springs, Ark. "*Woodson.*" 281
Plant, Invest in a..... 29
Plants, New..... 32, 98, 138, 212, 282, 350
Practical. *D. B. Beemer*.... 97, 211, 279, 347
Colorado Springs, News from. 336
Comments, Newspaper..... 206
Compressor and Pump, Double-Acting..... 155
Cone in Ice, White..... 156, 197
Conflict, No Natural..... 26
Construction, Ice House..... 193
Correspondence, Trade..... 99, 146, 199, 278, 336
Cost and Value of Low Temperatures. *John E. Starr, M. E.*..... 151
Cost of Refrigeration..... 283, 329
Creamery Ice House, Farm or 267

D

Damage Suits 269
Design for Ice House..... 346
Distillery Refrigeration, Artificial... 144
Double Acting Compressor and Pump 155

E

East Indies a Hundred Years Ago, Ice Making in..... 22
Economics of Refrigeration. *Prof. J. E. Siebel*..... 93
Eggs in Cold Storage, Holding. *D. B. Beemer*. 136, 211
Eggs, in Cold Storage, Holding..... 349
Electric Pipe Bending..... 259
Engineers Needed..... 155
Engineering, Refrigeration and..... 264, 331
Evaporation, Latent Heat of..... 84
Examination of Air, The Bacteriological. *Prof. J. E. Siebel*..... 208
Exchange, The Southern Ice 9, 148
Explosions, To Avoid Ammonia Drum..... 75
Eyes and Lungs, Protection of..... 157

F

Farm, Cold Storage and the.. ..... 96, 210
or Creamery Ice House..... 267
Fields, Harvest..... 338
Filler, Ice Can..... 219
Filter, How to Make a. *F. S. Allinder, M. E.* 202
Fires, Ice House and Factory, ... 17, 23, 77, 138, 219, 268, 343
Foreign Items..... ....79, 275, 340
Freezing Salmon..... 333
Frigorized Meat Export Trade, The..... 88
Fruit, Packing for Transportation..... 215
Steamers 326
Trade, The Modern..... 95
Transportation of..... 215, 326
Fun, Cold..... 102

G

Gas Escaping from Stuffing Boxes..... 154
in Refrigeration 202
Pressure of Ammonia. *H. John Krebs, M. E.*..... 340
Give Him a Chance..... 89
Great Icicle..... 98

H

Harvest Fields..... 338
Heat, Latent..... 98
Non-Conductors of. *John E. Starr, M. E.* 35
Non-Conductors of. *John M. Ordway*... 216
of Evaporation, Latent..... 84
Hotel Piazza, The Cool..... 222
Refrigeration 212
How to Make a Filter. *F. S. Allinder, M. E.* 202

I

ICE AND REFRIGERATION..... ..... 25, 26, 85, 147, 148, 205, 272, 337
Can Filler..... 219
Current Prices of..... 28, 150
Exchange, The Southern..... 9, 148
Factories, New..... 19, 76, 159, 198, 277
House, A Farm or Creamery..... 267
Construction..... 193
Design for..... 346
in Pioneer Days..... 203
Machine of the Future, The. *Prof. J. E. Siebel* 33

I

Ice Machine of the Future, The. *Stuart St. Clair*... 345
Machine, The Vacuum. *Prof. J. E. Siebel* 81
Machines, at Army Posts..... 196
New Liquids for..... 84
Making. *Charles W. Biese*..... 18, 73
in Cincinnati..... 78
in the East Indies a Hundred Years Ago 22
in Wilmington, Del..... 215
Plant, A Novel..... 341
Man, the Romantic Tale of the..... 337
Manufacturers' Association, South-West..... 131
Texas..... 71
Purity of. 86
v. Mechanical Refrigeration..... 334
White Cone in..... 156, 197
Icicle, A Great..... 98
Icy Items..... 32, 77, 138, 219, 350
Infection, Atmospheric Conditions and Bacteriological. *Prof. J. E. Siebel* 195
Introductory, Our..... 25

J

Just the Thing..... 86

L

Latent Heat... 98
of Evaporation..... 84
Legal Decisions 200, 268
Matters, Minor..... 160, 209, 268, 336
Living Room Refrigeration..... 148
Liquids for Ice Machines, New 84
Local Organizations..... 206
Low Temperatures, Cost and Value of. *John E. Starr, M. E.*..... 151
Lungs, Protection for Eyes and..... 157

M

Mains, To Cool Water in..... 201
Mayer, The Late Robert 139
Meat Export Trade, The Frigorized..... 88
Mechanical Refrigeration, Ice *v.*..... 334
Miscellaneous News Items..... 80, 135, 160
Modern Fruit Trade 95
Morals, A Question of 263
Motive Power Utilized for Refrigeration... 203

N

Natural Ice Notes..... 17, 99, 145, 209, 273, 344
Trade..... 99, 145, 209, 272, 343
New Books..... 148, 192, 259
Cold Storage Plants...32, 98, 138, 212, 282, 350
Ice Factories..... 19, 76, 159, 198, 277, 342
Liquids for Ice Machines..... 84
Refrigerants 143
Newspaper Comments..... 206
No Natural Conflict..... 26
Non-Conductors of Heat. *John E. Starr, M. E.*..... 35
Non-Conductors of Heat. *John M. Ordway*..216
Novel Advertising..... 98
Ice Making Plant, A..... 341

TITLES OF ARTICLES.

O

PAGE.

Official Notice, Southern Ice Exchange..... 148
Recognition 25
Only a Fable..... 22
Organizations, Local..... 206
Out of Sight..... 150

P

Packing House News..... 32, 80, 149, 204, 273, 350
Pioneer Days, Ice in..... 203
Pipe Bending, Electric..... 259
Pipe Line Refrigeration..... 14, 143, 144, 148
Portland, Ore., News from..... 336
Poultry and Cold Storage. *D. B. Beemer*. 97, 279
Poultry for Boston, Dressing 345
Practical Cold Storage. *D. B. Beemer*, ... 97, 211, 279, 347
Preparation of Brine 276
Pressure of Ammonia Gas. *H. John Krebs*. 340
Prices of Ice, Current 28, 150
Prophecy, Unfulfilled 153
Protection for Eyes and Lungs..... 157
Pump, Double Acting Compressor and..... 155
Purity of Ice..... 86

Q

Question of Morals, A 263

R

Railway Refrigeration..... 133, 213, 275
Notes..... 85, 215, 335

R

PAGE.

Refrigerants, New 84, 143
Refrigerating Apparatus. 154
Refrigeration and Engineering..... 264, 331
Artificial. *Auguste J. Rossi*, ... 12, 91, 141, 191, 260, 327
Artificial, Distillery..... 144
by Street Mains from a Central Station 14
Cost of..... 283, 329
Economics of. *Prof. J. E. Siebel*..... 93
Gas in..... 202
Hotel..... 212
Ice *v.* Mechanical..... 334
Living Room..... 148
Motive Power Utilized for..... 203
on Steamships..... 214
Pipe Line 14, 143, 144, 148
Refrigerator, A Steamship..... 135
Removals 32
Romantic Tale of the Ice Man, The..... 337
Room Refrigeration, Living..... 148

S

Salmon, Freezing..... 333
Shooting Artesian Wells..... 333
South, The Situation in the..... 158
Southern Ice Exchange..... 9, 25, 148
Ice Making Plant, A..... 22
South-West Ice Manufacturers' Association 131
Steamship Refrigerator, A..... 135
Refrigeration on..... 214

S

PAGE.

Stuffing Boxes, Gas Escaping from..... 154
Suggestions for Building..... 267
Suits, Damage..... 269

T

Temperature of Rooms, Regulating..... 29
Temperatures, Cost and Value of Low. *John E, Starr, M. E.* 151
Texas Ice Manufacturers' Association..... 71
The Universal..... 269
They Want the Earth..... 95
They will Kick..... 93
Trade Correspondence..... 99, 146, 199, 278, 336
Transportation of Fruit..... 215, 326
Packing Fruit for..... 215

U

Unfulfilled Prophecy..... 153
Universal, The..... 269

V

Vacuum Ice Machine, The 81
Pump, Double Acting Compressor and. 155

W

Water in Mains, To Cool 201
Weather, The..... 326
White Cone in Ice..... 156, 197
Wilmington, Del., Ice Making in..... 255

TOPICAL INDEX.

SUBJECTS MENTIONED NOT INDICATED BY TITLES OF ARTICLES.

A

Absorption Ice Machine..... 73, 191, 340
Agitator for Clearing Ice. 341
Agreements of Ice Manufacturers..... 131
Air, Bacteria in 208
Capability for Holding Moisture, ... 324, 326, 335
Cold, Refrigeration on Ships..... 135
Compressed Air..... 191, 214, 262
Dry, for Fruit..... 326
How to Get..... 335
in Cold Storage..... 334, 335
In Cold Storage Houses. 211, 334
In Ice 156
Spaces in Insulating Walls..... 37, 193
Weight of Cubic Foot..... 340
Alcazars..... 13
America Made First Ice Machine..... 260
Ammonia, Absorption by Water..... 73
Anhydrous 90, 93, 142
Confining..... 271
Expansion of..... 19
Gas 18, 149, 340
Condensation of..... 19
Pressure of..... 340
In Ice 86
Nitrate of..... 270
Pressure of, in Coils, etc 19, 271, 340
Restoring..... 208
Temperature..... 271, 340
Vaporizing Temperature 15
Analysis, Chemical, of White Cone..... 157
Argentine Meat Preserving Co..... 79
Argentine Republic, Frozen Meat from, ... 79, 88, 214
Armiger's, Richard, Car..... 133
Armour & Co.'s Refrigerator Cars..... 134
Armour Packing Co 281
Army Ice Making..... 146
Artificial Refrigeration and Ice Compared, 211
Advantages of..... 325, 334, 335
First Attempts..... 13
General Principles of..... 12
Associations, Necessity for..... 25
Atlanta, Ga., Ice Co. Plant..... 23
Prices of Ice..... 28, 153
Atlas Line of Fruit Steamers 326
Australia, Refrigerator Cars in 275
Ayer, John M., Car 214

B

Bacteria..... 87, 90, 195, 208, 338
Balling Pipe Coils..... 259
Baltimore P. O., Ice Contract..... 28
Bananas, Loading, etc..... 326
Banning, Colorado, Ice Canyon..... 135
Barmen, Refrigerating Chamber at..... 79
Barnard, Prof., Remarks by..... 261
Bar Pieces..... 148, 153, 201
Barrels for Packing 211
Bauer, Robt..... 272
Beaumont, Tex., Prices of Ice in..... 150
Beef, American Exports of..... 27
Shipping by Sea in Ice..... 79
Bender, E. P..... 80, 135
Benjamin, M..... 23
Berg, Walter..... 194
Bilyeu's, S. C., Car..... 133
Binks & Co.'s Electric Mercurial Thermostat..... 135
Birmingham, Ala., Prices of Ice..... 28
Bismarck, N. Dak., Prices of Ice..... 150
Black Enamel Paints..... 340
Black's Cold Storage System..... 281
Blowers in Cold Storage Rooms, etc., 97, 213, 214
Boilers, Clean, in Making Ice..... 157, 198
Book System of Selling Ice..... 150
Books Noticed:
Bacteriologische Diagnostik..... 148
Common Sense in Handling and Using Steam..... 259
Jahresbericht ueber die Leistungen, etc. 148
Key to Steam Engineering..... 259
The "Hercules Blue Book No. 1."..... 259
Thermodynamics, etc..... 192
Boston Ice to California..... 203
Poultry Dressed in..... 279, 345
Prices of Ice..... 150
Bowers, M. K..... 29
Boyle Ice Machines..... 24
Breeding Bacterial Germs..... 195
Brewers and the Ice Trade South..... 158
Brewery, Temperature in..... 271, 284
Cellars, Maintaining Cool 329, 330
Brisbane, Frozen Meat Trade 275
Bridgton, N. J., Prices of Ice..... 150
Brine Solutions..... 276
Mixing..... 339
Brown, H. C., Hotel..... 212

B

Brownsville, Tex., Ice Trade 196
Burmah, Steamship Line to..... 340
Butan..... 84
Butter, Device for Cooling..... 271
Making..... 96

C

Calcutta, Shipping Ice to..... 140
Caldwell, W. O., Biography..... 132
California, Freight Rates..... 275
Fruit Transportation Co 215
Ice in, Early Days..... 203
Camfield's, J. H., Car..... 133
Cans for Freezing Eggs..... 349
Ice..... 156, 157, 198, 219
Carbonic Acid..... 84, 183, 157 261
Carbonic Deoxide..... 90
Carre's Ice Machine 192, 327
Carrejun Vacuum Ice Machine..... 81
Cars, Passenger, Device for Cooling..... 29
Carthage, Mo., Price of Ice..... 140
Cattle Ships..... 37
Cave in Kansas, A Curious..... 325
Centralia, Ill..... 146
Chamberland Filter..... 90
Chapin Mine, Iron Mountain, Mich..... 264
Chapin, W. B., Suit by..... 260
Chappiers, J 84
Chattanooga, Tenn., Price of Ice..... 28
Chemical Analysis of Ice..... 86
Chemistry and Refrigeration 141
Cheyenne, Wyo., Price of Ice..... 150
Chicago, Burlington & Quincy R. R..... 29
Cold Storage Exchange..... 336
Consumption of Ice in..... 27
Prices of Ice 28, 272
Production of Manufactured Ice..... 27
Chloride of Calcium..... 142, 276, 329
of Menthyl..... 84
of Silver 142
of Sodium..... 276, 339
Chloroform, Pure 132
Christchurch, N. Z., Meat..... 88
Cincinnati, Ohio, Ice, etc..... 78
Circulation of Air, Advantages of..... 323
Climatic Changes, Effect on Fruit..... 326
Coal, Cost of 74, 256

TOPICAL INDEX.

C

PAGE.

Coils, Ammonia, Testing for Leaks in..... 259
Freezing Ice on, Direct..... 341
Cold, Artificial Production of..... 192
Dishes, Eating..... 196
Greatest Official Reported..... 207
Storage in Arkansas..... 281
in Country Towns.....29, 96, 350
in Early Days..... 97
Pipes in..... 324, 335
Taught by Nature..... 263
Influence on Bacterial Germs..... 195
Without Ice..... 90, 149
Columbus, Ga., Price of Ice..... 28
Compound Pump in Vacuum Machines..... 82
Compressor, Ice Produced by..... 339
Compressor Pump, to Keep Cool and Lubricate..... 342
With Cup Shaped Piston..... 342
Compressed Air, Cooling by..... 27, 203, 262
Gases, Wasted Energy of..... 33
Compression Ice Machines..... 19, 94, 95, 340
Concrete Floors in Ice Houses..... 194
Condenser in Refrigerating Machines..... 94
Condensing Surfaces and Moisture.211, 334, 335
Conductive Value, Unit of..... 36
Cone in Ice, What It Is..... 197
Congealer for Freezing Ice in Tanks..... 341
Connecticut State Board of Health..... 207
Cooling Agents, Duties of..... 35, 151
Cold Storage Rooms, Cost of, to Estimate..... 283
Water and Air by Evaporation..... 13
Wines in India..... 214
Co-operative Ice Making..... 29
Council Bluffs, Iowa, Prices of Ice..... 28
Creamery, The Largest..... 277
Critical Temperature of Gas..... 339
Cutting Prices, How It Results..... 206

D

Dairy Exhibit of Denmark..... 349
Ice at the..... 333
Damp Air in Cold Storage..... 97, 137, 143, 196, 334, 335
Davenport, Iowa, Academy of Science..... 147
Davis Refrigerator Car..... 97, 348
Dawley, C. W..... 72
Decatur, Tex., Prices of Ice..... 28
DeCoppet Absorption Device..... 73
Demerara, Shipping Ice to..... 336
Denver, Colo., Ice Dealers, etc..... 28, 96, 138
Rapid Transit and Transportation Co. 350
Denverside Packing House..... 350
Diamond Ice Co., Wilmington, Del..... 255
Distilled Water in Ice Making..... 27, 156, 157
Doors in Cold Storage Houses..... 151, 329
Dorr, A. L..... 257, 258
Draft, Acceptance of..... 200
Drainage of Ice Houses..... 153, 267, 346
Dressed Meat Trade..... 134
Dried Fruits, Preserving..... 95
Dry Atmosphere for Preserving Food. 137, 143
Drought in Maine..... 343
Ducretet's Cryogen..... 143

E

East Indies, Making Ice in..... 22
East St. Louis Packing House..... 350
Edson's Ammonia Pressure Gauge..... 256
Egg Cans for Freezing..... 349
Cases and Fillers..... 211
Eggs, Care of in Cold Storage..... 96, 98, 136, 196, 211, 271, 344, 349
How Measured by Bakers..... 349
Preserved by Freezing..... 349
Egypt, Ice Machines for Army in..... 196
Eichberg, A. S..... 23
Electric Alarm for Ammonia Drums..... 75
Current for Decomposing Water..... 34
Thermometer..... 210
Electricity and Refrigeration..... 34, 135
Ellis, Abe..... 11
Ely's, E., Car..... 133
Energies, Conversion of..... 34
Energy in Compressed Gas, Equivalent of. 33
Engine and Compressor Cards..... 258
in Ice Making..... 146
Ether as a Refrigerant..... 261

E

PAGE.

Eureka Refrigerating Co..... 260
Evans, Henry J..... 349
Evaporation, Cooling by....13, 22, 91, 98, 191, 192
Evolution in Ice Making..... 146
Excelsior in Egg Cases..... 211
Experts and Refrigeration..... 280
Exports to Spanish Americas..... 90

F

Fahrenheit's Zero, How Obtained..... 92
Fall River, Mass., Price of Ice..... 150
Family Ice Machine..... 135
Faraday's Experiment..... 141, 191, 327
Fermentation, Acids of, Used..... 143
Fillers, Second-Hand, in Egg Cases..... 211
Filters in Ice Making..... 198, 202, 257
Fire-Proof Compound..... 218
Fish, Freezing, etc..... 333, 335
Floors in Cold Storage..... 330
of Ice Houses..... 193
Florida, Hammett & Noel..... 356
Fort Payne, Ala., Price of Ice..... 150
Fort Worth, Tex., Price of Ice..... 28, 150
Freezing Compounds..... 90, 92, 192, 270
of Vegetables, to Prevent..... 98
Process in Mining..... 264. 331
Water on Ammonia Pipes..... 341
Freights in California..... 150, 275
to Texas..... 336
French Industrial Exposition..... 327
Frozen Meat from Argentina..... 79, 88
from New Zealand..... 79, 88
Prejudice against..... 88
Fruit, Consumption of..... 215
in Cold Storage..... 137, 208, 212
Packing for Shipment..... 214
Shrinkage of..... 326

G

Gainesville, Tex., Price of Ice..... 28
Galligher, F. L..... 200
Galvanized Iron Pans for Ice House..... 267
Gas, Critical Temperature of..... 340
Gases and Refrigeration..... 142, 154, 191, 255
under Pressure..... 191, 192
Gay, C. M..... 132
Gifford, P., Steamship Refrigerator..... 214
Gorrie's, J., Ice Machine Described..... 262
Grapes, Crop of, in Michigan..... 203
Preserving in Cold Storage..... 95, 348
Spanish, Exported..... 326

H

Hailstones, Large..... 330
Hall, J. & E., Refrigerators..... 135, 214
Hamilton Tank in Cars..... 134
Havana, Cuba, Ice Machines at..... 340
Heat, Laws of..... 151, 216
Hicks, Prof..... 153
Hoag's, C. L., Car..... 133
Hollow Tile in Walls..... 37
Hoosack Falls., Mass., Price of Ice..... 28
Hopkinson, Dr. John..... 82
Howe, W. H..... 11
Hoossa Colliery Shaft..... 264
Hudson River Ice..... 87
Ice Fields..... 344
Pullution by Sewerage..... 338
Hutchins Refrigerator Car Co..... 215
Hydrocarbons..... 84
Hydrogen and Oxygen, Use of..... 33

I

Ice, Amount Used in Cars..... 134
and Artificial Refrigeration Compared 211
Box, to Keep Clean..... 89
Boxes, Good and Bad Forms of..... 323
to Remove Smells from..... 325
Sweating of, How Caused..... 325
Temperature in..... 323
Breaker, a Norwegian..... 79
Consumption of, in Refrigerators..... 152
Crane for Lifting..... 258
Cutter, a Steam..... 258
Daily Report of Sales of..... 259
Dealer, Complaints of..... 89
Delivery Men, Profits by..... 337

I

PAGE.

Ice, Efficiency for Cooling..... 330, 335
Factories North, Growth of..... 20, 76
Factories South, Growth of... 19, 76, 158, 277
Houses, Building..... 267, 346
Impurities of..... 87, 207, 338
Keeping..... 157, 204, 263
Machines, Cost of..... 74
Machines, Views of..... 206
Made Direct from Water..... 82
Making, Cost of..... 74
Established Industry..... 20
from Undistilled Water..... 341
Plant, Operating for Profit..... 18
Prejudice against..... 26
Sketch of in U. S..... 18
without Cans or Molds..... 341
Mission..... 270
on Railway Cars..... 270
Position in Box..... 271
Quantity Produced by a Compressor.... 339
Removing when Frozen in Tanks..... 341
Systems of Cold Storage..... 334
Thickness of, in Streams..... 147
Trade of 1891..... 209, 272
Warranty in Sale of..... 268
Icebergs in Antarctic Ocean..... 349
Icing Stations for Cars..... 134
Infection of Bacteria, etc..... 196
Insulating Materials..... 35, 217, 219, 329
Walls..... 36, 37, 193, 216, 267
of Cars..... 134, 213, 214
Insulation, Cash Value of..... 36, 151
How to Estimate Value of..... 35
Importance of..... 153
of Refrigerators..... 283
Isobutylen..... 84
Italian Government..... 196

J

Jacksonville, Fla., Price of Ice..... 150
Jewell Filter..... 257
Jones, Harry..... 281

K

Kane Polar Expedition..... 148
Kaw Valley Potato Association..... 210
Kingan's System of Cold Storage..... 97
Knox, Geo. F..... 194
Koch's Gelatine Plates..... 195

L

Labor, Cost of..... 74
Lake Champlain Ice..... 28
Lakes, Ownership of Beds of..... 200
Langenbeck, Karl L..... 86
Latent Heat..... 83, 90, 98
Leavenworth, Kan., Prices of Ice..... 28
Le Dausk, Manufacture of..... 340
Leslie, Prof., Experiments of..... 92, 191
Liability for Goods in Storage..... 200
of Employers..... 200
License Tax on Wagons..... 87
Lime, Sulphate of, in Brine..... 339
Limed Eggs..... 137
Linde Ice Machine..... 265
Lithograph Frozen in Ice..... 98
Locomotive Breeze..... 194
Lombard, Capt. J. E..... 153
Loomis, M., of Huse & Loomis..... 272
Lount, S. D., Process of Ice Making..... 341
Compressor Pump by..... 342
Lowe, T. C. S..... 261
Lumber for Ice Houses.....339, 346
Lyman's, A. S., Car..... 133

M

McCrea's, A. L., Car..... 133
McMillan, Jas., Creamery Ice House..... 267
Macon, Ga., Ice War at..... 28
Maine, Drought in..... 343
Ice, Demand for..... 343
Massachusetts State Board of Health....87, 338
Max Mine..... 264
Meat, English Imports of Dead.....84, 88, 348
Preservation of Dead..... 90, 149, 214, 267
Temperature Required for..... 334
Mechanical Equivalents of Heat..... 139

TOPICAL INDEX.

M

PAGE.

Mechanical Refrigeration, Advantages of, ... 325, 334, 335
Mediterranean Fruit Trade 326
Memphis, Tenn., Price of Ice 28
Mercury Freezes 144
Messenger, R. A 154
Metric System 208
Mexico, Ice Making in 201
Meyer, Dr., of Denmark 349
Microbes 84
Mining Shaft, Sinking by Freezing 266, 331
Mobile, Ala., Ice Trade 198
Moisture in Cold Storage House 137, 211, 334, 335
in Ice Boxes 324
in Non-Conducting Walls 193, 218
Mountains in Nature 263
Munson, Mass., Hailstone at 330

N

Nashville, Tenn., Price of Ice 28
Natural Gas in Ice Making 202
Ice, Compared with Made 26, 149, 206, 207
Supplanted in certain Trades 27
will be Permanent 27
Nehrlick, H 154
Newark, N. J., Prices of Ice 28, 150
New Orleans Ice Trade 198, 260
New York Crescent Co 349
City, Price of Ice 28, 88, 150
New Zealand, Meat from 79, 84, 214, 275
Non-Conductors of Heat 37, 216, 217, 218, 329
Note, Acceptance of 268

O

Oats, Packing Eggs in 211
Opaque Ice, Making 84
Openings in Ice Houses 193
Orchards, Development of 95
Organization, Effects of 132

P

Packing Houses, Cleanliness of 135
Ice in Storage 194, 339, 346
Panama, Price of Ice 79
Paper Fillers in Egg Cases 137, 211
in Insulating Walls 37
Patents Noticed:
Ammonia, Process of Making 220
Apparatus for Cooling Air 101
for Cooling Pumps 39
Artifical Skating Rink 351
Condenser Coil 39
Cooler and Freezer 101
Cooling Apparatus 38
Compression Pump 40
Cutter for Ice Plow 101
De-aerating Water 285
Ice Creeper 101, 101
Cutter 38, 100, 286
Machine 40
Making Machine 39, 221, 285, 285
Making and Refrigerating Apparatus 351
Tongs 221
Milk Cooler 221
Non-Heat Conducting Compound 161
Oiling and Cooling Apparatus 39
Pipe Coupling 40
Refrigerating Apparatus for Cars 38
Apparatus 351
Attachment 100
Composition 39
Device 100
Machine 40
Valve 39
Refrigerators, 38, 40, 100, 101, 101, 101, 161, ... 161, 220, 220, 221, 221, 286, 351
Car or Building 40, 101
Steam Condenser 161
Switch for Ice Shute 221
System for Cooling and Distributing Drinking Water 351
Patten's Vacuum Ice Machine 82
Pawtucket, R. I., Price of Ice 28
Penobscot River Ice Fields 343
Pentan 84
Perkins, Jacob, Machine 260
Permanganate of Potassium 202

P

PAGE.

Peru, Ill., Ice Fields Abandoned 338
Philadelphia, Price of Ice 28
Warehousing and Cold Storage Co 31
Phœnix, Ariz., Ice Making in 341
Pictet, Chemist 132
Pictet's Liquid, Composition of 27, 99
Pieper, Carl, on Vacuum Ice Machine 82
Pine, Yellow, in Walls 37, 339
Pipe, Line Refrigeration:
at Alleghany 144, 212
at Denver 14
at Kansas City 144
at New York 280
at St. Louis 14, 148
Central Station 17
Economy of 143
First Plants 14
General Principles 14
Regulation of Temperature 16
Pittsburgh, Price of Ice 28, 150
Plate System 255
Poetsch, F. H., Freezing Process 264
Polhamius, F. M 72
Pork, German Embargo on 204
Portland, Me., Price of Ice 150
Ore., Price of Ice 28, 153
Portraits Taken through Ice 257
Potatoes, How to Keep 210
Poultry, Fattening, Freezing, etc 279, 347
Dressing for Market 345, 348
Ranch for Fattening 279, 347
Pusey's, Lea, Ice Cutter 258
Pressure, to Calculate Loss of 208
Prickly Heat, Relief from 203
Priming, How to Ascertain 339
Propylen 84
Prudden, Dr., on Hudson River Ice 87
Pullman Cars, Cooling 29

Q

Quicksand, Frozen, Characteristics of 332
Quincy, Ill., Ice Machines Made 24
Quivi, J., Refrigerating Media 84

R

Rankin's, Thomas L., Car 133
Rapp, George W 78
Raum, Gen. Green B 269
Reboiling Water for Ice Making 197
Reciprocity with Spanish America 138
Refrigeration, Cost of 329
Refrigerating Capacity Calculated 149, 329
Economy in 93
Machines Not Perfect 33, 345
How They will be Improved 345
Pipes in Ice Houses 194
For Drying Cold Air 334, 335
Refrigerator Cars 97, 133, 134, 326
Circulation of Air in 323
Ships 84, 88
Test of 152
Refrigerine Salts 269, 345
Regnault's Table 271
Repairs on Ice Machines 74
Rimmon Pond, Conn., Ice from 207
Rink, Skating, in Summer 144
Rockford, Price of Ice 28
Roofs of Ice Houses 193
Roses Frozen in Ice 153
Rudloff's Double-Acting Compressor, etc 155
Ruemelin's Biography of Mayer 139
Rushton, William J 11

S

St. Louis, Price of Ice 272
Salina, Kan., Hailstone at 330
Salt and Ice for Cooling 192
for Brine Solutions 276
Salmon Freezing in Washington 277, 333
San Antonio, Tex., Price of Ice 28
Sanborn's, R. W., Car 133
San Francisco, Price of Ice 28, 150
Savannah, Ga., Price of Ice 28
Sawdust in Ice Houses 193, 267, 346
Schneidlinger, Prussia, Mine at 264
Schoenbein & Mayer 140
Schroeter, Results Attained by 94
Scot, The Steamship 135

S

PAGE.

Season of 1890 in the South 25
Seed Potatoes, Care of 210
Sellers, William & Co 258
Sewage, Contamination by 338
Shaft, Sinking by Freezing 264, 266, 331
Show Pieces 148, 153, 201
Siberia, Cold in 143
Sicily, Oranges from 336
Siemens, Prof. W., Mine for 264
Smells in Ice Boxes, to Remove 325
Smith, Frank A 269
Sneath, R. G 275
Snow Storms, Curious Incidents of 78
Use of for Ice 203
Soda, Sulphate of, in Brine 339
Soldiers and Ice Machines 196
Soluble Glass Solution 213
Solutions, Brine, Compound 276
Mixing 339
Sooysmith-Poetsch Freezing Process 264
Southern Ice Trade 19, 27
Spain, Shipping Goods to 204
Spanish American Trade 90
Grapes, Exported 326
Specific Heat of Brine Solutions 276
Springfield, Ill., Pure Ice and Cold Storage Co 194
Stanley, H. P 348
Steam Pipes Used for Cooling 29
Stockholm, Sweden, Tunnel at 264
Storage Houses for Ice 194
Strawberry Season Prolonged 95
Strawboard in Egg Cases 137
Sulphurous Acid 82, 84, 157
Sutherland's, J. B., Car 133
Sweating in Ice Boxes, How Caused 325
Syrups, Cooling in the Tropics 13
Systems of Ice Making 19

T

Tanks, Freezing Water in 341
Ice, in Cold Storage Houses 97
Water, in Ice Factories 156
Tatties in East Indies 22
Temperatures, Equalization of 216
in Ice Boxes 323
Low Cost of 151
Low, Easier to Hold 284
of Living Rooms 148
Thermodynamics, Principles of 33
Thermometers, Electrical 210
Thilorier's Apparatus 142, 191
Thoma's, A., Car 213
Three Rivers, Quebec 80, 135
Tichborne, Parley & Purcell 143
Tiffany's, Joel, Car 274
Toad in Ice 275
Toledo, Ohio, Price of Ice 28, 150
Topeka, Kan., Price of Ice 28
Trade Journal, The 25, 207
Letters, Desired 270
Transparent Ice 83
Freezing in Tanks 341
Troops, Transportation of 196
Tubes, Sheet Metal, for Splitting Ice 341
Tudors, Exporters of Ice 140
Tunstall's, Richard J., Car 133
Turner's, James, Car 213
Turner, R. W., Consul 204
Turning Egg Cases 137
Twinning's Machine Described 260
Tyndall and Mayer 140
Typhoid Fever among Ice Cutters 338

U

United States, Exports of Dead Meat 84, 88
Universal Refrigerating Co 269

V

Vacuum Ice Machines, Principles of 27, 81
Vaseline and Iron Rust 214
Vegetable Trains from California 335
Ventilated Cars for Fruit 215, 326, 335
Ventilation of Ice Houses 193, 267
Vitrified Pipe Conduits 14
Volatile Liquids 91, 143, 192

TOPICAL INDEX.

W

PAGE.

Wallston's Experiment..... 92
Warner, E. T..... 255
Washington Market, New York..... 280
Watcom, Freezing Salmon at.....277, 333
Water, Boiled, Freezing of..... 214
  Dripping, in Cold Storage..... 335
  Purification in Steams..... 338
  Refrigerating Agent..... 81
  Test of Purity..... 202
  Undistilled Artesian..... 271
  Weight of Cubic Foot..... 340

W

PAGE.

Watermelon Trade..... 95
West Indies Ice Co..... 79
Whitewashing Egg Cases..... 271
  Ice Houses..... 193
Wickes', James H., Car..... 274
Wild Pigeons, Shipping..... 97
Williams, John Lloyd..... 22
Winants', Josiah E., Car..... 214
Winds in East Indies..... 22
Winhausen Ice Machine..... 81, 192
Wire Cloth for Drying Cold Air..... 335

W

PAGE.

Wisconsin Ice, Price of..... 272
Wolf, Otto C..... 31
Wood, Arthur B..... 201
  Fillers for Egg Cases..... 211
  George K..... 133

Z

Zimmerman's, A. W., Car..... 214

INDEX TO ILLUSTRATIONS.

Ammonia Drum: Safety Device..... 75
Armour Packing Co. Cold Storage House, Hot Springs, Ark.:
  Front Elevation..... 281
  Ground Plan..... 281
  Side Elevation..... 282
Atlanta Ice Co. Plant: Exterior and Ground Plan..... 23
Bacteria: Breeding Pans..... 195
Cincinnati Ice and Cold Storage Co. Plant:
  Exterior—Front Elevation..... 78
  Ground Plan..... 79
  Sectional View..... 78
Device for Protecting Eyes and Lungs..... 157
Diagrams:
  Apparatus for Bacteriological Examination of Air..... 208
  Circulation of Air..... 323, 324
  Cyrophorus..... 92
  Distillery Arranged for Artificial Refrigeration..... 144
  Double-Acting Compressor and Pump.. 155
  Engine and Compressor Cards, Diamond Ice Co..... 258
  Faraday's Experiment..... 141
  Filter..... 202
  Ice House Plans..... 346
  Ice Machine, Carre's..... 327, 328
  Ice Machine, Gorrie's..... 262
  Ice Machine, Twinning's..... 261
  Ice Machine, Vacuum..... 82, 83
  Ice Machine, Volatile Liquids..... 262
  Ice Report, Daily, Diamond Ice Co..... 258
  Insulation for Ice House Walls..... 194
  Motor Power Utilized for Refrigeration 203
  Patents.....38, 39, 40, 100, 101, 102, 161, 220, 221, 285, 286, 351
  Refrigerating Apparatus..... 154
  Showing the Consumption of Ice..... 152
  Stuffing Boxes..... 155
Diagrams:
  Vapor Tension..... 340
  Vessel in Which Water may be Decomposed by Electricity..... 34
Diamond Ice Co., Wilmington, Del.:
  Engine and Compressor Cans..... 258
  Freezing Room..... 256
  Loading Platforms..... 257
  Portraits..... 255, 257
  Report Card, Daily..... 258
Earth Freezing at Iron Mountain, Mich.:
  General View of Site, Showing Pipe Connections, etc..... 265
  Head of Ground Pipe..... 266
  Junction of Frozen Ledge and Quicksand..... 332
  Profile of Shaft, Showing Arrangement of Freezing Pipes and Connections..... 266
Egg Can..... 349
Headings of Departments:
  Artificial Refrigeration..12, 91, 141, 260, 327
  Cold Storage..... 29, 96, 136, 210, 279, 347
  Engineering and Architecture .193, 264, 331
  Ice and Refrigerating Machinery, ... 33, 81, 154, 201
  Ice Making.....18, 73, 156, 197, 276, 341
  Ice Trade Notes.....17, 99, 145, 209, 272, 343
  Insulation..... 35, 151, 216
  New Ice Factories... 19, 76, 159, 198, 277, 342
  Official Notices..... 148
  Packing House Refrigeration, ... 32, 80, 149, 204, 350
  Railway and Steamship Refrigeration, ... 133, 213, 274
Humorous:
  Cool Hotel Piazza..... 222
  Out of Sight..... 151
  They will Kick..... 93
Ice Can Filler..... 218
Ice Cans..... 198
Illuminated Initial Letters:
  A..... 195, 281, 326
  B..... 349
  M..... 88
  N..... 158
  S..... 283
  T.....97, 211, 345
  W..... 93, 334
Philadelphia Warehousing and Cold Storage Co., Plant:
  Ice Machine House..... 31
  General View of Premises..... 30
Pipe Line Refrigeration at St. Louis, Mo.:
  Branch Pipes and Sewer Boxes..... 15
  Butcher's Box..... 16
  Conduit, Showing Pipes and Connections Inclosed..... 15
  Interior View, Showing Arrangement of Service System..... 16
  Manhole, Showing Arrangement of Pipes..... 14
  Manhole, Looking Down..... 14
Portraits:
  Biese, Charles W., Chattanooga, Tenn. 10
  Boyle, The Late David, Chicago..... 24
  Caldwell, W. O., Ft. Smith, Ark..... 130
  Dawley, C. W., Dennison, Tex..... 71
  Dorr, A. L., Wilmington, Del. (taken through fourteen inches of ice)..... 257
  Ellis, Abe, Columbus, Ga..... 11
  Gay, C. M., Carthage, Mo..... 132
  Howe, W. H., Nashville, Tenn..... 10
  Mayer, Bust of the Late Robert Julius . 139
  Polhamius, F. M., Texarkana, Tex..... 72
  Rushton, William J., Birmingham, Ala. 9
  Warner, C. T., Wilmington, Del..... 255
  Warner, C. T., Wilmington, Del. (taken through fourteen inches of ice)..... 257
Refrigerator to Cool Water Mains..... 201

HERCULES

Ice and Refrigerating

MACHINE

(REFRIGERANT: ANHYDROUS AMMONIA.)

FOR

BREWERIES, PACKING HOUSES, COLD STORAGE.

. . . Artificial Ice Plants . . .

DRIVEN BY INDEPENDENT CORLISS ENGINE, WHICH CAN BE USED TO OPERATE OTHER MACHINERY.

Strongest, Most Durable and Most Economical Machine

ON THE MARKET

Our Guarantee is the Highest given by any Company, and Every Machine Sold has Exceeded the Guarantee.

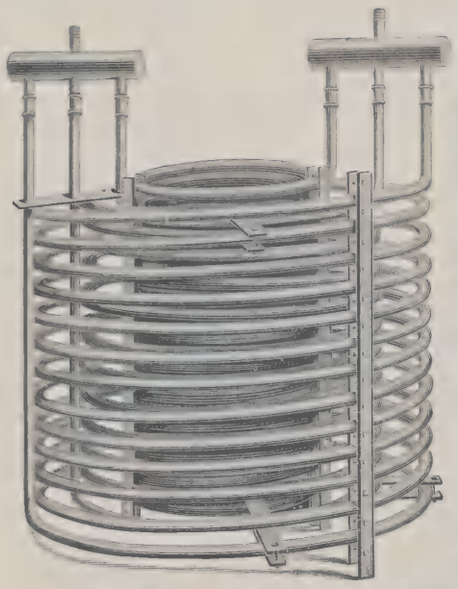
SEND FOR ILLUSTRATED CIRCULAR AND REFERENCES.

THE HERCULES IRON WORKS,

ROOM 502 OWINGS BUILDING,
DEARBORN AND ADAMS STS.

CHICAGO . .

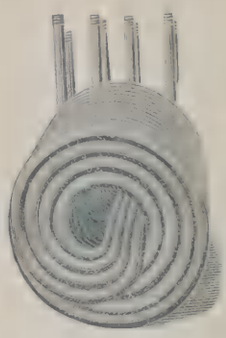
WORKS, AURORA, ILL.



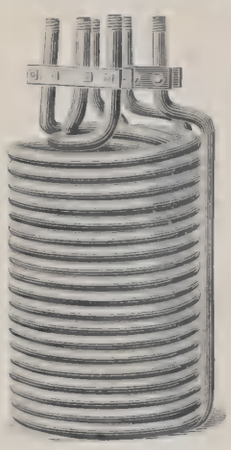
JAMES D. CARDELL. WASHINGTON HOPKINS.

James D. Cardell & Co.

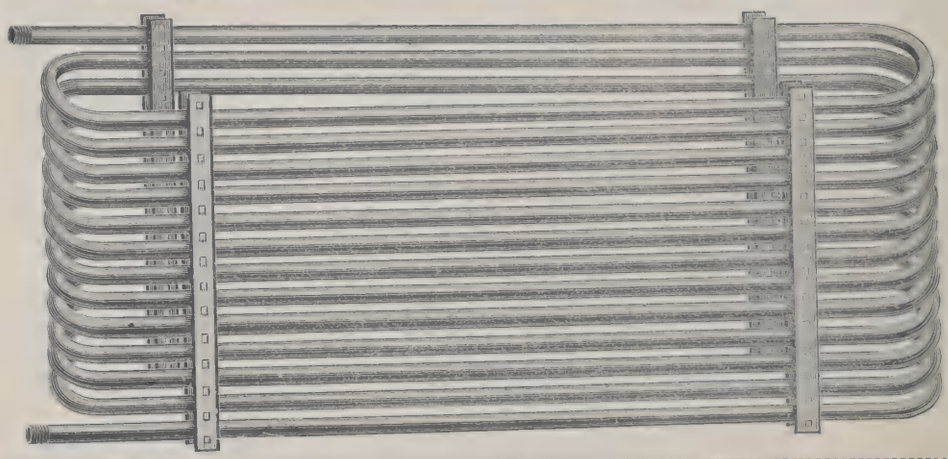
PIPE BENDING WORKS,
RISING SUN LANE & NORTH PENN R. R.
PHILADELPHIA, PA.
MANUFACTURERS OF
IRON, BRASS AND COPPER COILS,
FOR ICE AND REFRIGERATING MACHINES,
CHEMICAL WORK, SOAP FACTORIES,
FEED-WATER HEATERS, ETC.
COILS OF ANY DESIRED WELDED LENGTH



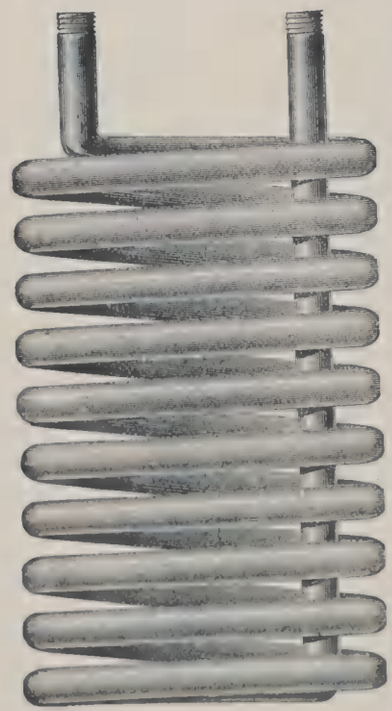
BENDING @
Of Large Sizes
Pipe a specialty
SEND FOR CATALOGUE.



Brine and Condenser Tanks, Ammonia Bottles, Ammonia Valves, Flanges, ETC.



THE HARRISBURG PIPE BENDING CO. LIMITED



WORKS, S. E. CORNER HERR STREET AND PENNSYLVANIA CANAL. HARRISBURG, PA.

.....MANUFACTURERS OF.....

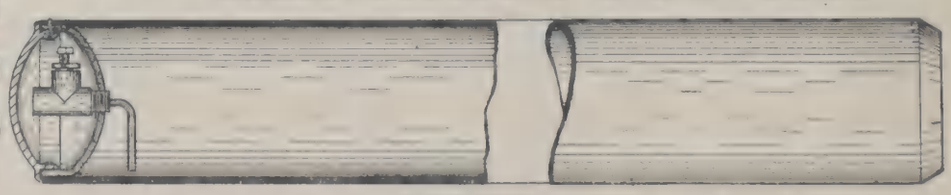
COILS AND BENDS

Of Wrought Iron Pipe . . For Ice Making and Refrigerating

in Round, Oval, Zigzag, Spiral, Helical and Tapering Forms.

CHEMICAL WORKS, FEED-WATER HEATERS,
BLAST FURNACES, EVAPORATING LIQUIDS,
AMMONIA MACHINES, SOAP WORKS, ETC.

IRREGULAR PIPE BENDING A SPECIALTY



AMMONIA BOTTLE.

AMMONIA . BOTTLES . OR . FLASKS . WITH . WELDED . HEADS

STRAIGHT OR CONCAVE

Write for Prices on the . . . . . .

CORRUGATED... ...WATER-TUBE **FEED-WATER HEATER**

More Effective and Durable . . . . . .

Than a Coil Heater at the Same Price.

SOLE MANUFACTURERS:

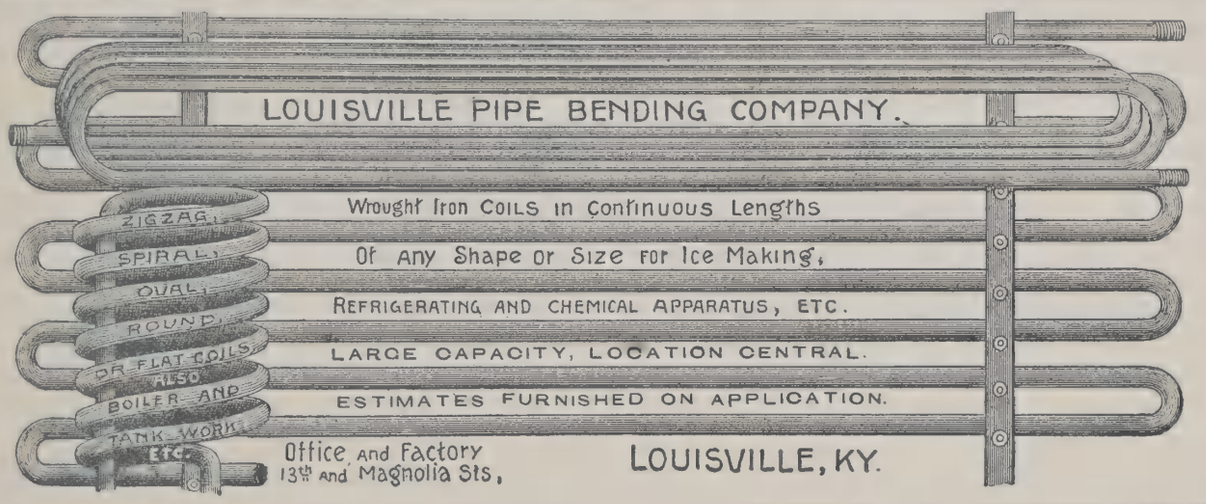
The Wainwright Manufacturing Co. of Mass.

8 Oliver Street, BOSTON.

SEND FOR CATALOGUE I. C.

CHICAGO: 26 West Randolph Street.

NEW YORK: 121 Liberty Street.



1821 ·:· PIONEERS IN PIPE MAKING AND COILING IN THIS COUNTRY. ·:· 1891

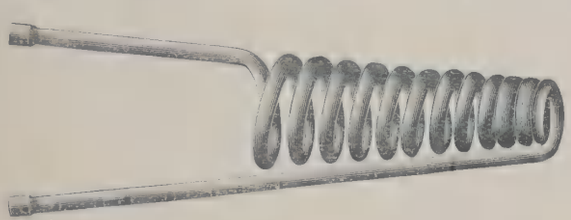
MORRIS, TASKER & CO.

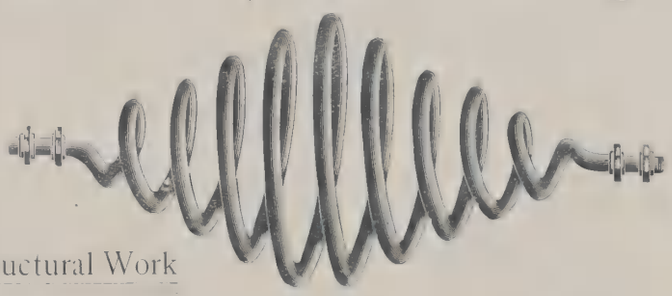
(INCORPORATED.)

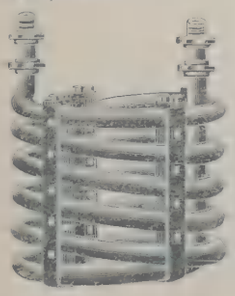
OFFICES: 222 & 224 SO. THIRD ST., PHILADELPHIA.

MANUFACTURERS OF

Boiler Tubes, Wrought Iron Pipe and Fittings







Gas Works and Structural Work

HEAVY CASTINGS, TOOLS AND MACHINERY.

Every Style of PIPE COILS, including all varieties for ICE and REFRIGERATING MACHINE PLANTS, a Specialty. . . . . .

PASCAL IRON WORKS. PHILADELPHIA.

DELAWARE IRON WORKS NEW CASTLE, DEL.

New York Coal Tar Chemical Co.

10 WARREN ST., NEW YORK.

MANUFACTURERS OF

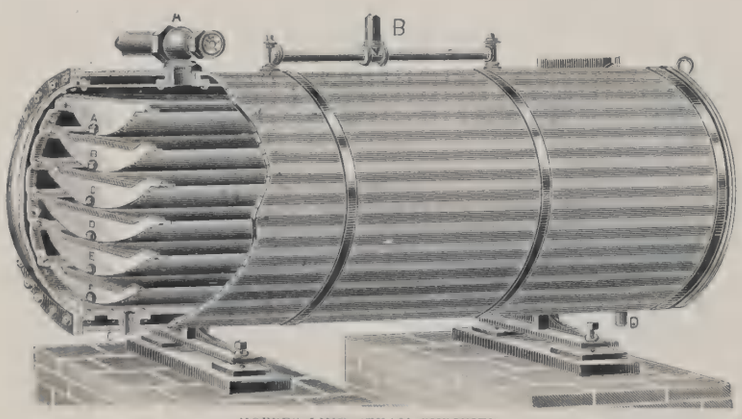
ABSOLUTELY PURE

ANHYDROUS AMMONIA

AND

AQUA AMMONIA

FOR REFRIGERATING PURPOSES.



HOPPES LIVE STEAM PURIFIER.

THE

"HOPPES"

Live Steam Feed-Water

PURIFIER

Is especially adapted to ICE MAKING PLANTS, as pure water is essential to insure a good quality of ICE. The use of the HOPPES PURIFIER will insure you pure water, by removing all of the impurities therefrom, at the same time keeping your boilers clean and free from scale without the use of boiler compounds or scale solvents.

CATALOGUES, ESTIMATES, SPECIFICATIONS, ETC., CHEERFULLY FURNISHED.

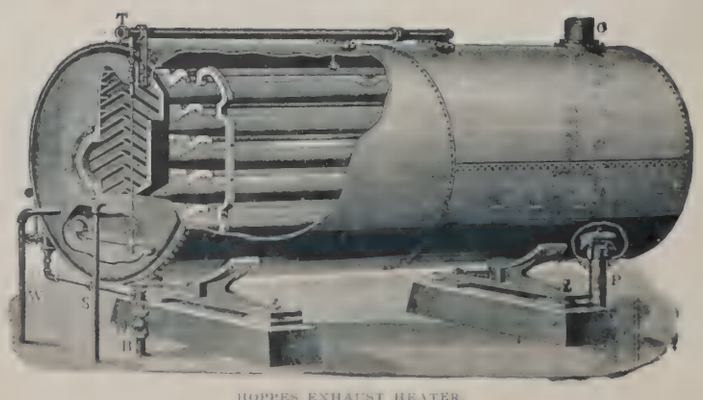
THE HOPPES MFG. CO., SPRINGFIELD, O.

IF YOU WANT TO GET THE FULL BENEFIT OF YOUR EXHAUST STEAM, INVESTIGATE THE

"HOPPES"

Exhaust Steam Feed-Water

HEATER



HOPPES EXHAUST HEATER.

The National Ammonia Co.

... ABSOLUTELY DRY AND PURE ...

Our Ammonias are the Recognized Standards of Quality. Use Our Brands and Secure the Best Results with your Machines.

LIQUID ANHYDROUS AMMONIA AND AQUA AMMONIA (ALL STRENGTHS),

For Refrigerating and Ice Machines.

GENERAL OFFICES:--ST. LOUIS, MO.

We are the Largest Manufacturers in the World. Send your Orders to Us and Get Prompt and Satisfactory Service.

Our Ammonia can be had of the following Agents:

NEW YORK—The De La Vergne Refrig. M. Co.
W. M. Schwenker.
Mallinckrodt Chemical Works.
PHILADELPHIA—Theo. J. Goldschmid.
BALTIMORE—Wm. Mitchell.
WILMINGTON—Delaware Chemical Co.
BUFFALO—Kast Copper & Sheet Iron Co.
ST. LOUIS—Mallinckrodt Chemical Works.
Larkin & Scheffer.
CINCINNATI—Herman Goepper & Co.
CLEVELAND—Benton, Myers & Co.
DETROIT—Michigan Ammonia Works.
KANSAS CITY—Henry Menderson.
CHICAGO—A. Magnus' Sons.
Fuller & Fuller Company.
MILWAUKEE—The Chas. Baumbach Company.
SAN FRANCISCO—Herrmann & Company.
PORTLAND, ORE.—Snell, Heitschu & Woodard.

B. P. CLAPP AMMONIA COMPANY,

MANUFACTURERS OF

ABSOLUTELY PURE - - 26° AQUA AMMONIA

Containing 29 ¼ per cent of Ammonia.

FOR REFRIGERATING PURPOSES AND THE TRADE . . . . . .

GENERAL OFFICES:

245 BROADWAY, NEW YORK.

THE CLEVELAND ANHYDROUS AMMONIA WORKS

THOS. FLESHER, JR., Proprietor.

MANUFACTURERS OF ...PURE...

Anhydrous Ammonia.

70 E. Prospect St., CLEVELAND, OHIO.



GEO. WOOLFORD,

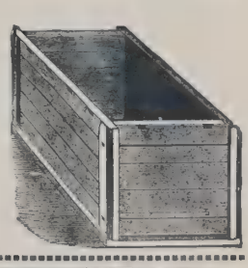
Manufacturer of all kinds of

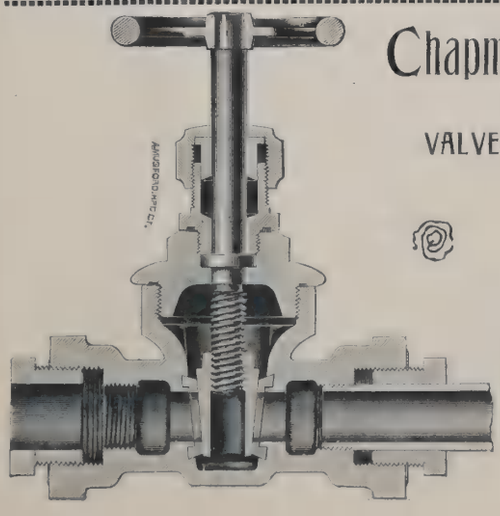
Cedar Vats, Tanks, HOT AND COLD Water Tanks, Railroad Tanks

In sending for estimates, state if measurements are inside or outside, and thickness of wood desired . . . . . .

FOR ICE FACTORIES, COLD STORAGE HOUSES RAILROADS, PACKERS, CHEMICAL WORKS, ETC.

2240, 2242 and 2244 North 9th Street, PHILADELPHIA.





Chapman Valve Manufacturing Co.

.....MANUFACTURERS OF.....

VALVES AND GATES FOR WATER, GAS, STEAM, ACID, OIL, AMMONIA, ETC.

ALSO GATE FIRE HYDRANTS

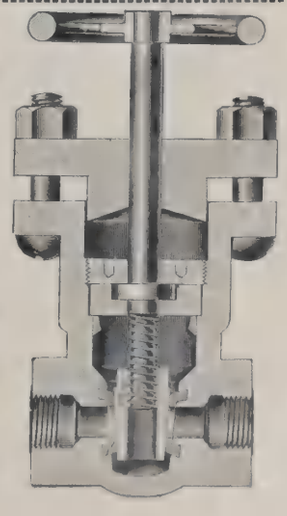
SPECIAL ATTENTION GIVEN TO

VALVES FOR REFRIGERATING, COLD STORAGE, ICE MAKING MACHINERY, ETC.

We make the best Valve for Ammonia Heavy Pressure in the market. The two illustrations here represent Ammonia Valves that are giving universal satisfaction.

General Office and Works, INDIAN ORCHARD, MASS.

Treasurer's Office, 72 Kilby and 112 Milk Sts. BOSTON, MASS.



THE LAIDLAW & DUNN CO.

PURCHASERS OF { McGOWAN PUMP CO. / ECLIPSE PUMP MFG. CO.

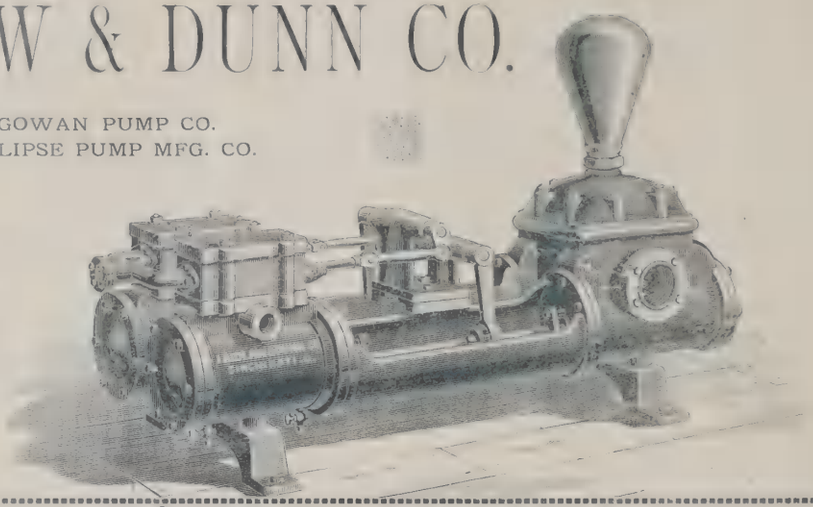
MANUFACTURERS OF

BRINE
WATER
BREWERY

PUMPS

AND PUMPS FOR ALL PURPOSES.

CINCINNATI, OHIO.



AMMONIAL
LIQUID . . . .

PUMPS



ICE MAKING AND
REFRIGERATING PLANTS

These Pumps are made very heavy and guaranteed to work smoothly against 300 pounds pressure to the square inch . . . . . .

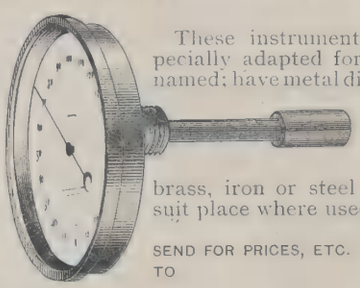
VALLEY PUMP CO.

EASTHAMPTON, MASS.

Standard Thermometers.

FOR USE IN

Ice Machines,
Refrigerators,
Brine Tanks,
Ammonia
Circulating Pipes,
Etc., Etc.



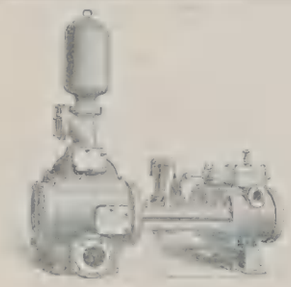
These instruments are especially adapted for purposes named; have metal dials, either brass, iron or steel casing to suit place where used.

SEND FOR PRICES, ETC. TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Cortlandt St. Boston Office, 70 Pearl St.



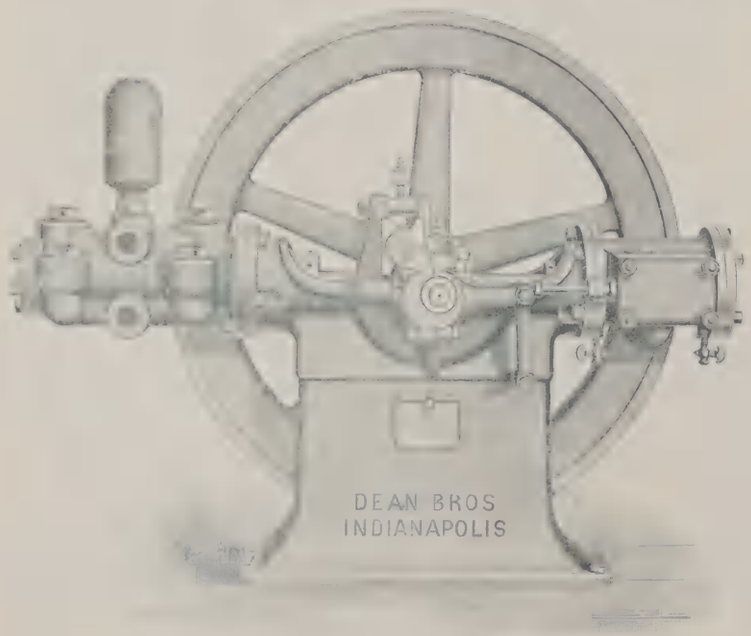
DUPLEX WATER SUPPLY PUMP.

DEAN BROS.

· Steam Pump Works ·

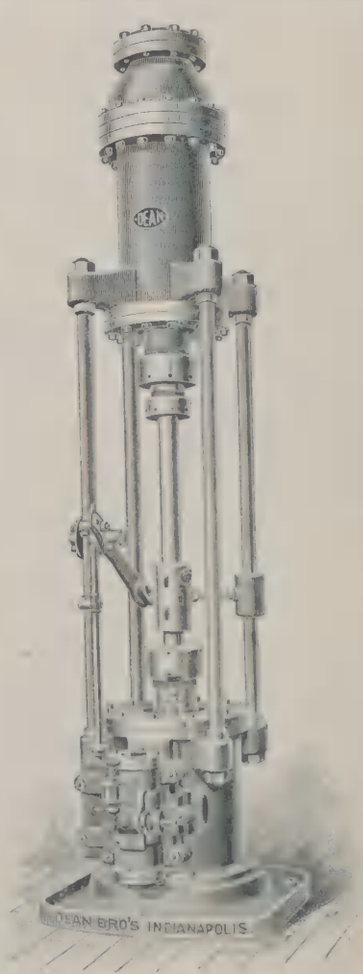
INDIANAPOLIS, IND.

BOILER FEEDERS, BRINE PUMPS,
DEEP WELL PUMPS, SINGLE AND DUPLEX PUMPS.

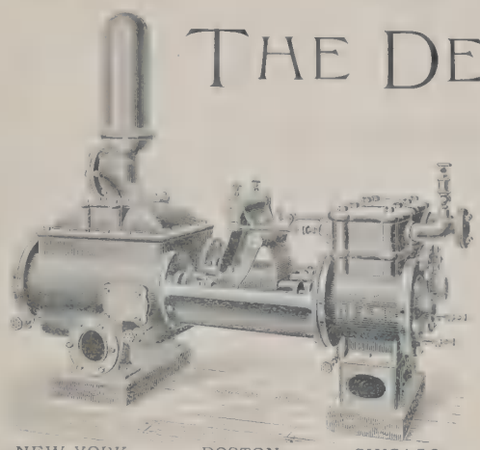


HORIZONTAL AMMONIA PUMP.

SEND FOR CATALOGUE



VERTICAL AMMONIA PUMP



THE DEANE STEAM PUMP CO.

HOLYOKE, MASS.

STEAM PUMPS

FOR EVERY SERVICE.

AMMONIA PUMPS,
BRINE PUMPS,
TANK PUMPS, ETC.

For Ice Manufacturing Machinery

For full information and Illustrated Catalogue, write . . . . . .

NEW YORK. BOSTON. CHICAGO.
PHILADELPHIA. ST. LOUIS. DENVER.

DEANE STEAM PUMP CO., Holyoke, Mass.

A. D. COOK,

.....MANUFACTURER OF.....

COOK'S IMPROVED

DIRECT . . .

ACTING . . .

Deep Well Pump

THIS Pump has no "dead center," always starting when steam is turned on. Will work without shock or jar, as the amount of steam for downward or upward stroke can be regulated by the engineer. There being separate adjustable valves for upward and downward strokes, a perfectly uniform motion is produced without regard to weight of the reciprocating parts. This improved form of direct acting Steam Pump is especially designed for NON-FLOWING Artesian or Tube Wells, where water does not rise to within drafting distance of the surface, and will successfully raise water from the deepest wells. The Pump Bucket discharging on the up stroke and the Top Plunger discharging on the down stroke, make the flow of water steady and continuous.

ALSO MANUFACTURER OF

COOK'S PATENT . . . .

Tube Well Strainers

AND GENERAL

TUBE WELL SUPPLIES.

LAWRENCEBURG, IND.

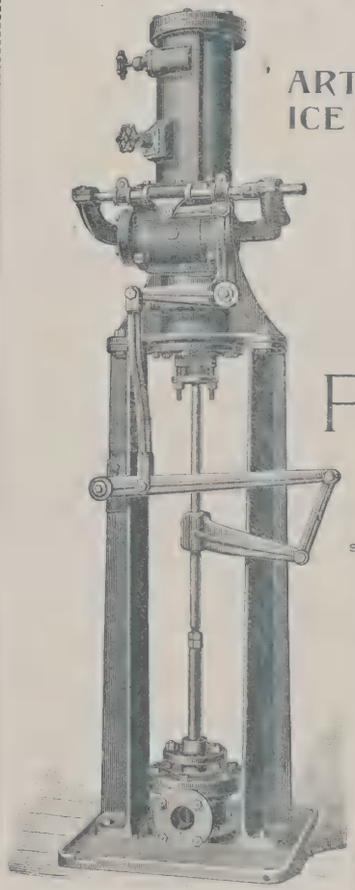
EPPING Pump

. . . DEEP-WELL . . .

FOR

ARTIFICIAL ICE COMPANIES

BREWERIES
COLD STORAGE
WAREHOUSES



PUMPS

For all Purposes.

SEND FOR CATALOGUE TO

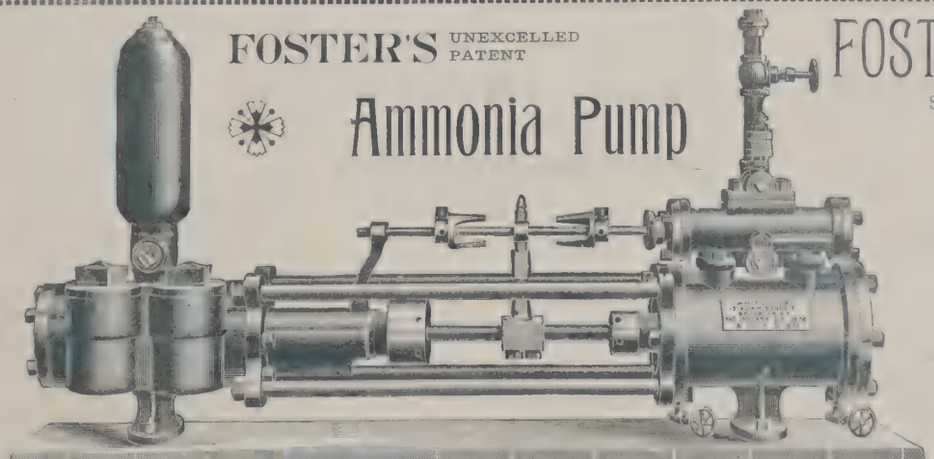
EPPING, CARPENTER & CO. LIMITED.

2410-2420 Penn Ave.,

PITTSBURGH, PA.

FOSTER'S UNEXCELLED PATENT

Ammonia Pump



FOSTER PUMP WORKS

Successors to WILLIAM FOSTER,

MANUFACTURERS OF

PATENT IMPROVED

STEAM PUMPS

FOSTER'S EXCELSIOR ROTARY PUMPS.

Beer and Mash, Boiler Feed, Tank, Air, Deep Well and Artesian Well Pumps.

36 AND 38 BRIDGE ST. BROOKLYN, N.Y.

The advantages of this Pump are, its extra long double stuffing-box, which is so arranged that any leakage from first stuffing-box is carried back into the suction again. It has extra hard steel Piston Rod, which is made in two sections, so as to be easily replaced when ammonia part of piston rod is worn out, and without necessitating the removal of the steam portion of rod.

HERF & FRERICHS CHEMICAL CO.

ST. LOUIS, MO.

MANUFACTURERS OF

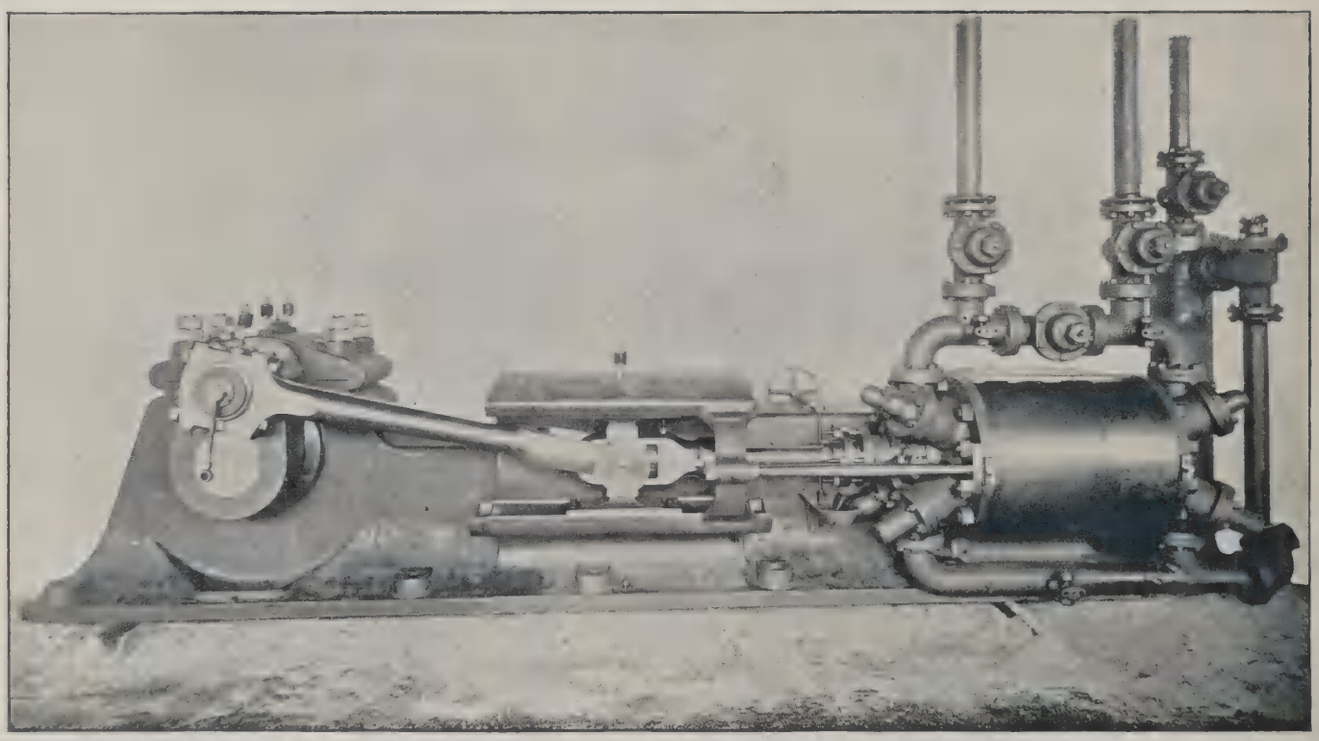
Liquid Anhydrous Ammonia

ABSOLUTELY DRY, PURE AND UNIFORM ALL THE YEAR ROUND . . . . .

26° Ammonia

SPECIALLY PURIFIED FOR ABSORPTION MACHINES . . . .

All our Ammonia is made from Sulphate Ammonia only. Large capacity, best qualities and quick shipments.



No. 8 LINDE COMPRESSOR

100 TONS CAPACITY.

MANUFACTURED BY

THE FRED. W. WOLF CO.

560 North Halsted Street, CHICAGO, ILL., U. S. A.

FOR ICE FACTORIES, COLD STORAGE HOUSES, BREWERIES AND PACKING HOUSES . . . . .

CORRESPONDENCE SOLICITED.

OVER 1300 MACHINES IN ACTUAL OPERATION.

ICE AND REFRIGERATION

ILLUSTRATED

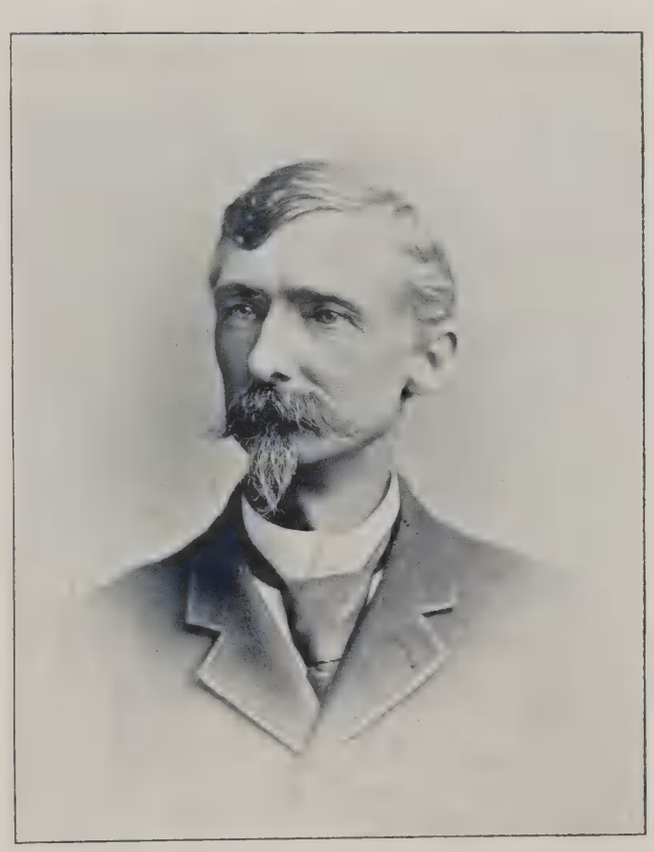
A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. I. NO. 1. CHICAGO : NEW YORK : JULY : 1891. $2.00 PER ANNUM.

THE SOUTHERN ICE EXCHANGE.

THE PLANS AND OBJECTS OF THE ASSOCIATION—HISTORY OF ITS ORGANIZATION—PROCEEDINGS OF THE FIRST ANNUAL CONVENTION—PORTRAITS AND BIOGRAPHICAL SKETCHES OF THE OFFICERS.

The Southern Ice Exchange is, as its name implies, an association of Southern ice manufacturers and dealers who have banded together for mutual protection and advantage. It is not, however, in any sense of the word, a "trust," or an "associate corporation," for the purpose of securing a monopoly of the ice business, neither is it the intention to in any way control the production, or local prices to consumers.



WM. J. RUSHTON, PRESIDENT, BIRMINGHAM, ALA.

The main object of the Southern Ice Exchange, as formulated by its organizers, is to establish and perpetuate an association which shall be, in a manner, a medium of communication between members of the trade, for the purpose of disseminating knowledge of value in the making and selling of ice, and thus by an exchange of ideas and experiences to improve and increase the general fund of information. And also, by establishing friendly relations with each other, to prevent ruinous competition, often caused by erroneous reports and other vexatious misunderstandings.

The Exchange, although only a little more than a year old, already numbers among its members many of the largest and most influential manufacturers and dealers in the South, and as its aims and purposes become better known, is certain to be in a short time one of the largest and most prosperous associations in the country.

HISTORY OF ITS ORGANIZATION.

The origin of the Southern Ice Exchange is largely due to Mr. L. S. Young, of Gadsden, Ala., and Mr. Chas. W. Biese, of Chattanooga, Tenn. These two gentlemen had frequently consulted with each other in reference to the management of their plants, and in this way the thought suggested itself that it would be of great benefit to the management of the different ice manufacturing plants in the South to confer on the subject.

Mr. Biese immediately went to work and consulted with Mr. W. H. Howe, of Nashville, and Mr. Peter Kern, of Knoxville, from whom he received encouraging replies. In consequence, a circular letter was sent to all managers of ice factories throughout the South, calling their attention to the matter, and inviting all to attend a meeting to be held February 12, 1890, at Chattanooga, Tenn.

Many very cheering replies came from all over the south, and when the day of the meeting arrived a fair representation of the manufacturers of ice were present, and an organization of a Southern Ice Exchange was perfected.

The convention was held in the Chamber of Commerce. A constitution and by-laws were adopted, and considerable other business transacted. The following officers and executive committee were appointed : President—W. J. Rushton, Birmingham ; Vice-President—C. W. Biese, Chattanooga ; Secretary—Abe Ellis, Macon, Ga. ; Treasurer—Louis P. Hart, New Orleans. Executive Committee—S. J. Whitesides, Central Ice Co., Savannah ; J. Hodge McLean, Chattanooga ; M. Benjamin, Atlanta Ice Co. ; T. H. Moore, Montgomery Ice Co. ; Mr. Weems, of Mississippi.

Telegrams and letters were received from several firms not present, who expressed their willingness to

abide by any action taken by the convention. An estimate, carefully prepared, showed that the companies represented at the meeting had a total invested capital of $3,000,000, with a daily output of over 2,000 tons of ice.

The date for the first regular annual meeting was set for the second Tuesday in February, 1891.

PROCEEDINGS OF THE FIRST ANNUAL CONVENTION.

Pursuant to the resolution passed at the meeting of February 12, 1890, the members of the Southern Ice Exchange assembled in convention, in the Chamber of Commerce, at Chattanooga, Tenn., February 25 last. Quite a number of new members joined the association.

The meeting was called to order by the president, Mr. W. J. Rushton, and the roll called, to which forty-five companies answered "present."



CHAS. W. BIESE, VICE-PRESIDENT, CHATTANOOGA, TENN.



W. H. HOWE, TREASURER, NASHVILLE, TENN.

Minutes of previous meeting were then read and confirmed. Reports of president, treasurer and secretary were read and adopted. The election of officers for ensuing year was deferred until the afternoon session.

The following committee of three was appointed by the chair to determine the advisability of building an ammonia plant, to be operated in the interest of members of the exchange, and the committee ordered to report at afternoon session.

Committee—Chas. W. Biese, W. F. Sugg, W. H. Howe.

It was moved that dues be reduced from $2 per ton on daily capacity, to twenty-five cents per ton, with an amendment, by Mr. Benjamin, to make it fifty cents per ton on capacity.

Mr. Rushton offered an amendment to first determine approximate expenses of exchange, and then decide on dues. This was carried.

Later, on motion, the annual dues were fixed at $5 per year, with initiation fee of $10.

The motion prevailing that a committee of five be appointed to bring forward questions for discussion at afternoon session, the chair named the following gentlemen: Messrs. Benjamin, Hensel, Hard, Kern and Palmer. An adjournment was then taken to 2.30 P. M.

AFTERNOON SESSION.

It was moved and seconded that a committee of two be appointed to visit and invite the manager of the local brewery to come before the convention and discuss the relation of breweries to ice factories.

Mr. C. W. Biese and Mr. P. Kern were appointed the committee.

It was then voted to take up the election of officers, and the following gentlemen were named and elected for the ensuing year: W. J. Rushton, Birmingham, Ala., president; C. W. Biese, Chattanooga, Tenn., vice-president; W. H. Howe, Nashville, Tenn., treasurer; Abe Ellis, Columbus, Ga., secretary. Executive Committee—S. J. Whiteside, Savannah, Ga.; A. J. Weems, Meridian, Miss.; J. Hodge McLean, Chattanooga, Tenn.; M. Benjamin, Atlanta, Ga.; C. F. Sugg, Huntsville, Ala.

It was moved and carried that the shipping rate of $6 per ton for ice, same as during 1890, should remain in force for the ensuing year. Adjourned to 7.30 P. M.

EVENING SESSION.

Moved and seconded that next annual meeting be held at Birmingham, Ala. Carried.

On motion, the chair appointed the following gentlemen to prepare and read a paper on subjects affixed to their names, at next annual meeting: Mr. Biese, on "Distillation"; Mr. Hard, on "Selling Ice"; Mr. Howe, on "Management of Factories"; Mr. Meadows, on

"Refrigeration"; Mr. Benjamin, on "Book-keeping and Accounts"; Mr. Cole, on "Ticket and Record System"; Messrs. Stell and Kern, on "Impurities in Ammonia"; Mr. Rushton, on "General Troubles of the Trade."

The matter of publishing a successful trade paper devoted exclusively to the interests of the ice trade, was discussed, and a committee of two—Mr. Charles W. Biese and Mr. M. Benjamin—was appointed to establish such a journal. After thoroughly canvassing this matter the above committee decided to make ICE AND REFRIGERATION the official organ of the Southern Ice Exchange, which action was approved. (See official document elsewhere in this issue.) The convention then adjourned *sine die*.

BIOGRAPHICAL SKETCHES OF OFFICERS.

Mr. W. J. Rushton, president of the exchange, was born in 1848. He was engaged for several years in the ice business at Columbia, Tenn., removing from there to Birmingham, Ala., January 1, 1881. With characteristic energy he at once organized a stock company and erected an ice factory in Birmingham, putting in a 45-ton Boyle machine. He was also largely instrumental in the building of other ice making plants in Alabama. Mr. Rushton is a busy man, being heavily interested in other corporations. He is president of the Birmingham Brewing Co., and is also president of the People's Savings Bank & Trust Co., of Birmingham. He has been in the ice business for fourteen years, having met with eminent success, and he is considered by the trade as being one of the best posted men in the business.



ABE ELLIS, SECRETARY, COLUMBUS, GA.

Charles W. Biese, of Chattanooga, Tenn., vice-president of the Southern Ice Exchange, was born in Holstein, Germany, November 8, 1835; came to the United States in 1860 and located in Chicago, Ill., where, in 1861, he enlisted in the federal army, served through grades of private, sergeant, lieutenant and captain in Thieleman's cavalry and 82d Illinois infantry regiment, resigning his commission in June, 1865, in the Officers' hospital on Lookout mountain. He then opened one of the first coal mines in that locality, which he operated three years. He was afterward connected with the Cherokee Mining & Manufacturing Co. until the company wound up its affairs, when he connected himself with the Georgia Coal Co. In 1869 he assisted in building bridges and trestles on the Alabama Great Southern road from Chattanooga to Meridian, Miss.; and later was engaged in the same business with the Alabama Grand Trunk railroad, with office at Mobile, Ala., and was after that engaged in the commission business for two years. In 1875 he returned to Chattanooga and engaged in the agricultural implement and general machinery business, which he sold in 1887 to his son Robert and a Mr. Dickinson.

In 1883 Mr. Biese attempted to form a company to engage in the manufacture of ice, but owing to another company starting in the same business at that time—parties who had interested themselves with him failed to comply with their agreement, and the matter fell through. In 1884 he again formed a company, of which the Lookout Ice & Cold Storage Co. is the outcome, and of which he is now manager, secretary and treasurer.

He is a republican, a member of the military order Loyal Legion; the G. A. R.; was post commander Lookout post, No. 2, during 1886; also a K. T., K. of P., etc.

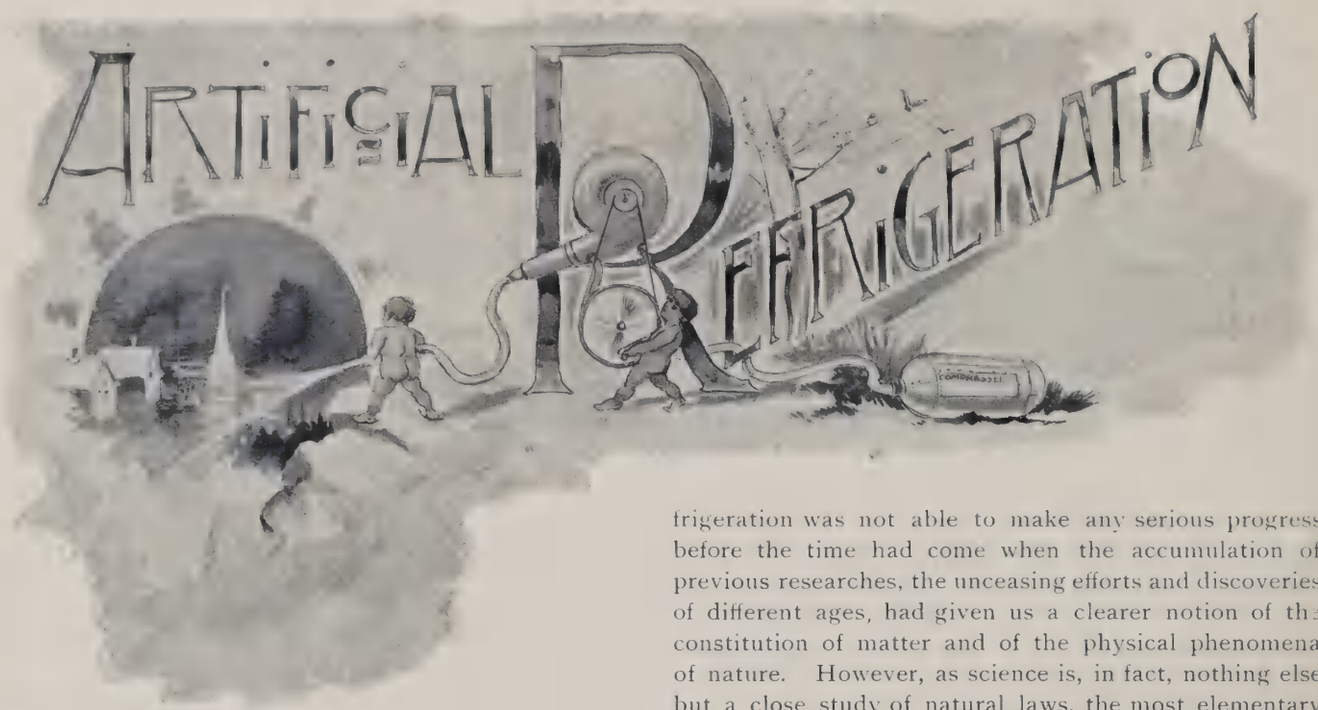
THE TREASURER, MR. W. H. HOWE.

Mr. W. H. Howe, the treasurer of the association, was born in Toronto, Canada, August 22, 1836. His youth, however, was passed in Pittsburgh, Pa. In 1857 he moved south, and when the civil war broke out he was living in Paris, Tex. After the war was over he settled in Hopkinsville, Ky., where he remained until 1878. In that year he went to Mobile, Tenn., and has resided there ever since. In early life he learned the watch making and jewelry trade, in which business he continued until 1878. Since that date he has been actively engaged in coal mining and in the ice business. He is at the present time general agent for the St. Bernard and Diamond coal and silver coke, and is also sole proprietor and manager of the Excelsior ice factory and cold storage houses. This plant consists of one 40-ton and one 60-ton Arctic machine. The ice making capacity is eighty tons per day, with 50,000 cubic feet of cold storage rooms. Altogether, it is one of the most complete and best equipped establishments of its kind in the country. The entire ice product is handled by Messrs. Howe & Parker, of which firm Mr. W. H. Howe is the senior partner.

Mr. Howe is a self-made man, having started in life without a dollar, and as the result of industry, economy and perseverance, has amassed a considerable fortune.

SECRETARY ABE ELLIS.

Mr. Abe Ellis was elected secretary of the exchange at the first meeting, and was re-elected at the annual convention of July last. Mr. Ellis was born in New York, October 2, 1855. He is a machinist and mechanical engineer, by profession. He was engaged in the manufacture of ice at Macon, Ga., for five years, being secretary, treasurer and general manager of the Central City ice works. Early this year he sold out his interests in Macon and removed to Columbus, Ga., where he is at present managing a small experimental plant.



[*Written for* ICE AND REFRIGERATION.]

ARTIFICIAL REFRIGERATION.

A CHRONOLOGICAL STUDY OF ITS DEVELOPMENT—ITS IMPORTANCE, ITS APPLICATIONS, ITS FUTURE.

BY AUGUSTE J. ROSSI, B. S., C. E.

GENERAL CONSIDERATIONS AND PRINCIPLES INVOLVED.

The importance of being able to control temperatures is obvious. Without it all idea of human comfort would have to be excluded, civilization itself would have remained at a standstill, and the development of our industries, as we understand it now, could not exist. As respects the highest temperatures, we can readily command by artificial means almost any degree of heat which we may require that nature does not in any way furnish, under ordinary circumstances. Combustion affords us heat in all quantities, though skill and knowledge may be and are required to derive from it all the available benefit we can obtain therefrom; though we do not, even in the present day, utilize it to the full extent possible, however the modes of producing it are well understood by all, and do not suppose the slightest technical knowledge. Fire has been known from time immemorial. The mode of producing cold, and its applications, are not so obvious; its action in preventing or checking the decomposition of organic matter is about the only one which we readily recognize, and the only means which suggested themselves to avail ourselves of this property have been, for many years past, to store it, so to speak, under the form of ice wherever nature furnishes us this product in abundant quantities. But, in many countries, where heat can just as easily be obtained as in colder ones, ice is either unknown or so sparingly formed by nature as to exclude the idea of its being harvested at all to contribute to our comfort, still less to promote the development of our industries.

GENERAL PRINCIPLES INVOLVED.

The conditions of production of depressed temperatures suppose, indeed, certain scientific and technical deductions, or, at least, a knowledge of certain physical laws; and this explains why this industry of artificial refrigeration was not able to make any serious progress before the time had come when the accumulation of previous researches, the unceasing efforts and discoveries of different ages, had given us a clearer notion of the constitution of matter and of the physical phenomena of nature. However, as science is, in fact, nothing else but a close study of natural laws, the most elementary of these laws had been early observed and received in years past some sort of application in this particular direction.

The words "cold" and "heat" are related to our senses, and have in themselves nothing absolute. If, after placing the hand in a vessel containing water at a temperature near that of the freezing point of water, 32 deg. F., we quickly dip it in another vessel containing water at the temperature of the atmosphere in summer, we will receive an impression of "heat." Let us dip the hand first, on the contrary, in water as hot as it is possible for us to stand it and, quickly removing it, dip it in this same water at the ordinary temperature, the sensation will be one of "cold." Thus the same liquid has alternately given us an impression of heat or cold, according to circumstances.

In certain countries it is practicable, and it has been done for years, to preserve the ice formed during the winter for use in summer by storing it in appropriate magazines, in cellars, as in the seventeenth century, or, as for centuries, in natural caves.

Whenever a liquid passes to the vapor state, a certain phenomenon takes place, the importance of which cannot be overrated and which it is necessary to understand well to be able to grasp the principles on which most of the methods of artificial refrigeration are based. If a vessel containing water is placed on a fire maintained constantly burning, as everybody knows and can easily verify, the temperature of the liquid rises gradually, a thermometer placed in the liquid showing a constant increase until the liquid reaches the point at which it boils—for water, until a temperature of 212 deg. F. is thus reached. But this point reached, and the water being in full ebullition, it will be observed that the thermometer remains stationary, and that, too, as long as there is water left to evaporate in the vessel. The source of heat, the fire, supplying all the time the same amount of heat as has before gradually raised the temperature of the liquid to 212 deg. F., we are forced to admit that the heat thus supplied heat which does not become sensible to the thermometer—which is "latent," as it is called, has become necessary for, and,

therefore, has been applied to bringing about merely the change of state from the liquid to the gaseous form, the temperature of the resulting steam being 212 deg. and no more.

If the temperature of the liquid thus boiling and changing state remains stationary, it must be because, as long as there is liquid left to boil—for whatever time is consumed to evaporate it completely—the supply of heat from the fire is equal to the demand made upon it for the transformation of the liquid to gas. If we conceive that the evaporation of the liquid be maintained in some other manner than by the source of heat (as will be explained further), we can realize then that this heat, found absolutely necessary from observation to produce the change of state, not being supplied any more by a fire, will have to be borrowed from somewhere, from the surrounding objects, at the expense of the heat of the liquid itself, in fact, if no other immediate and direct source is available, and the temperature of the liquid must and will necessarily fall to supply the heat for the evaporation of a part of the liquid.

There are numbers of liquids which, indeed, evaporate so freely as to produce a sensible degree of cold without any special arrangement to obtain such result. If the hand moistened with water is exposed to the air, a sensation of cold is distinctly perceived. If alcohol be substituted for water, the sensation will be more marked; and with ether, or light products of petroleum, it may become intolerable. A current of air blowing upon the moistened surface will accelerate the evaporation (the passage from the liquid to the gaseous state), thereby increasing the intensity of the cold. This tendency to evaporate freely in the air diminishes as the temperature of the latter diminishes, but even with water there is not any point at which it really ceases. It has been found by actual experiments that evaporation proceeds at the surface of snow, at a temperature of 32 deg. F. in the open air at the rate of "as much as sixteen grains of water per square foot of surface per hour." At 0 deg. F. it is still "about four grains per square foot per hour," and even at a temperature of 32 deg. F. below 0 deg. F., it is still sensible, amounting to a fraction of a grain sufficient "to the production of two or three pounds of watery vapors per acre per hour."

The pressure, the weight, of the atmosphere, by resisting the expansion of the vapors produced, has a retarding action when it increases and an accelerating one when it diminishes. It might be reduced to such an extent—for instance, by rarefying the air by exhaustion from a closed vessel containing the water—as to cause the actual boiling of the water at a temperature much below that at which this liquid boils at the ordinary pressure of atmosphere. The evaporation or concentration of syrups in what are called "vacuum pans," is based on these observations.

FIRST ATTEMPTS AT INDUSTRIAL APPLICATION.

This spontaneous evaporation in the open air has been made available from time immemorial in India for the production of ice. The method consists in exposing the water in shallow vessels during a bright night to the open air. Excavations, twenty to thirty feet square and about two feet deep, are sunk in an open space, the floor, or ground, being covered with dry straw or stalks of corn or sugar cane. Upon this layer of non-conducting materials are placed the water vessels, made of porous earthenware, and no more than one inch deep, which allows the water to exude at the surface, thus increasing the surface exposed to evaporation. In the morning the vessels are found to contain thin sheets of ice. In this case, the liquid passing to the gaseous state, evaporating spontaneously, and not being able to abstract from external sources, such as the soil, the amount of heat necessary for this transformation, on account of the bad conducting properties of the materials on which the vessels are purposely laid, and the air in the ditches not supplying it quick enough, borrows it from its own heat, and the temperature falls to such a degree as to cause a part of the water to freeze. This process was successfully imitated in England in the latter part of the last century, and also in southern France and southern Europe, and attempts have even been made to apply it systematically to the manufacture of ice in summer. It proved economically a failure. The porosity of the vessels favors, of course, the evaporation.

Similar porous vessels, but closed and of different shapes, wrapped or not in moistened cloth, have been in use from times almost immemorial in Egypt, India, and, later on, in southern Europe and tropical countries of Central and South America, to hold water to be used for drinking purposes in summer; the continuous evaporation of the water exuding through the pores of the vessels to their outside surface having a cooling action on their contents. In the West Indies and Spanish countries they are known under the name of "Alcarazas." Of the same order is the crude practice of the Arabs, and, after them, of the French soldiers in Algeria, to spread a woolen blanket, saturated with water, on four pickets at a certain distance from the soil; the spontaneous evaporation of the water exposed on such a large surface to the action of the air, in a clear night, cools rapidly the liquid, which is squeezed out from the blanket for drinking purposes. This spontaneous evaporation of water, in the conditions mentioned above, plays a prominent part in the cooling effect obtained—in many cases the exclusive part. It should be added, however, that it is promoted to some extent by what is called the radiation of heat in open space, in a clear night. The rapidity of the evaporation is considerably promoted, and the cooling effect produced much increased, by increasing the surface of the water exposed to this action of the air, as we have seen. In southern tropical countries, where cane sugar is manufactured, it has been the practice for many years past to pump up the syrups to the top of high columns, 100 feet high, and thus discharge them over a sort of cooler made of vertical walls of interlaced small branches of trees, over and through which the warm liquid, delivered at the top, trickles down to the lower part, to be there collected in a proper trough. The action of the air, by promoting the evaporation, is sufficient to bring down the temperature of the syrups from 180 deg. or 160 deg. F. to 80 deg. or 90 deg. F., and even less. Based on the same principle, though in this case the cooling obtained is not the object in view, is the practice in certain countries situated on the sea shore, to obtain salt from the sea water by concentrating the latter, by several passages over such contrivances, before evaporating the richer salt solution thus obtained by means of heat.

[TO BE CONTINUED.]

REFRIGERATING BY STREET MAINS FROM A CENTRAL STATION.

A COMPLETE DESCRIPTION OF THE SYSTEM AS OPERATED IN ST. LOUIS AND THE WORK TO BE ACCOMPLISHED BY IT.

An important advance in the line of central station service, and one which has passed the early experimental stage and is firmly fixed as a commercial enterprise, is the distribution of cooling power by underground pipe lines in the streets from a central plant.

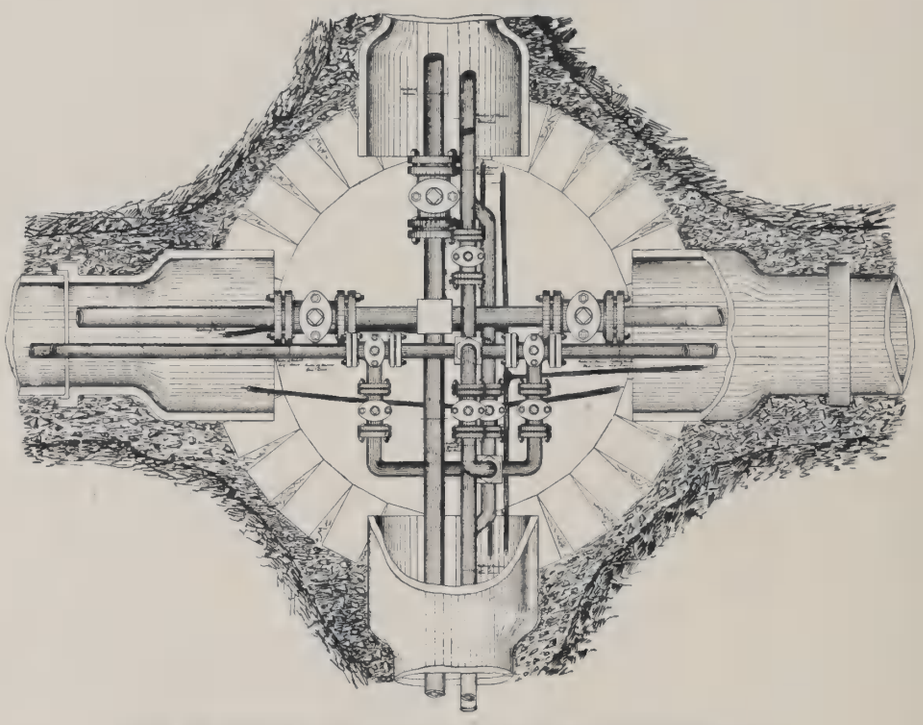
Plants for this purpose have been in operation for some time in Denver, Colo., and St. Louis, Mo., but so quietly has the work of their introduction and operation been prosecuted at these points, that the general, or even the local, public are scarcely aware of what has been and is being done in this important direction.

The cooling agent employed is ammonia gas. The system as operated in St. Louis by the St. Louis Automatic Refrigerating Co. perhaps exhibits the highest type of development, as the work there represents the combined results of years of patient and, perhaps, costly experiment, and the practical experience of a few persistent men, who, four or five years ago, were dubbed "dreamers and enthusiasts" by some of the refrigerating profession.

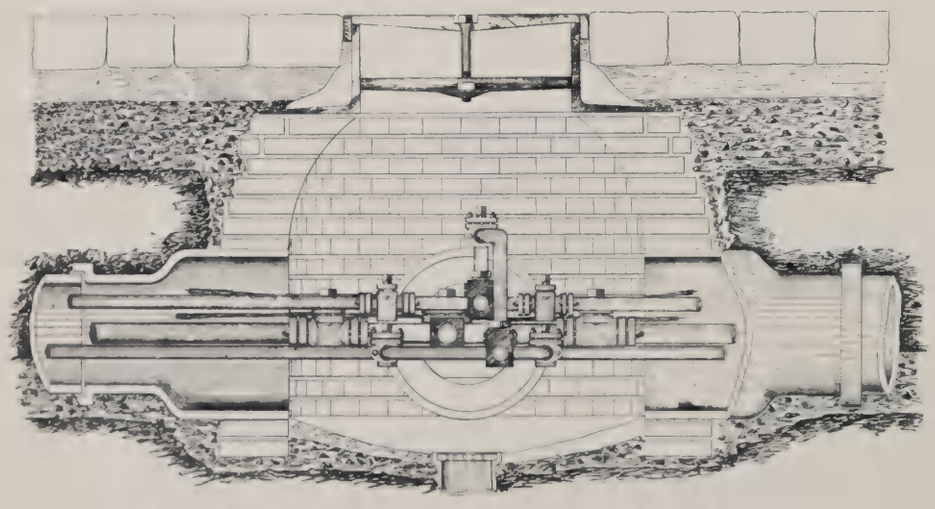
The first pipe line work under this system was installed in Denver, Colo., in the spring of 1889, and has been operating satisfactorily ever since. About a mile and a half of street mains have been operated at that point, the principal customers being butchers, hotels, restaurants, saloons and commission houses. Measures are now being taken in Denver to very largely increase the plant and extend the pipe line.

The first street line in St. Louis was put in operation in May, 1890, and since then the business has increased very rapidly. The St. Louis company are operating under a general franchise to lay its pipes in the streets and alleys of the city, obtained from the city legislature in 1890. About a mile of street mains were laid last year, and they are now vigorously prosecuting the work of pushing their lines throughout the business part of the city.

In constructing the street lines, a half section of twelve-inch vitrified pipe is first laid in the trench, solidly imbedded in a concrete base. The wrought iron piping carrying the refrigerating agent is then laid on specially prepared saddles in this half formed conduit. After the piping has been thoroughly tested for leaks, the other half, or top section, is laid on. A projecting lip is molded on the edge of the lower half section of pipe, and when the top section is laid on, soft liquid cement is poured along the upper side of this lip, making a water tight joint. The joints between each length of vitrified pipe are also carefully cemented, so that when the work is complete, the entire piping system is inclosed in a water tight conduit of great strength.



VIEW OF MANHOLE AT STREET INTERSECTIONS—LOOKING DOWN.



SECTIONAL VIEW OF MANHOLE, SHOWING ARRANGEMENT OF PIPE LINES.

Manholes are provided at nearly all street crossings, supplied with suitable cocks and valves for shutting off or turning on different sections of the line, and at the foot of grades these manholes have sewer connections to provide for complete drainage in case of accidental leaks of water into the conduit. (See illustration.)

The pipes are carefully painted, and being secure from contact with the soil or water, and, of course, being of extra thickness, a very long life is expected for them.

Service connections are made at the rate of about 150 to the mile, and branch pipes and service boxes at the sidewalk are provided the same as in water and gas distribution.

The piping system consists of three lines of extra strong ammonia pipe connected by special steel fittings. All screw joints are provided with improved stuffing



VIEW OF BRANCH PIPES AND SERVICE BOXES.

boxes and glands, so that leakage is rendered impossible. A rigid system of inspection and testing is used before and after the line is laid.

One of these lines is called the "liquid line," and is used to carry the liquid anhydrous ammonia under pressure, and distribute it by branches to the customer.

The second pipe, of larger diameter, is called the "vapor line," or return main, and is also connected with branches with each customer's box. Its office is to return to the factory the expanded ammonia gas, after it has performed its refrigerating work in the box.

The third pipe is called the "vacuum main," and is connected, at various points along the main line and at each customer's box, with both the liquid and vapor pipes. It is connected at the factory with a vacuum pump, and its office is to clear of gas any section of either main line or branches, or the coils in the customer's box, so that repairs can be made without loss of gas to the company, or smell or other inconvenience to the customers. It may be also used as a "by-pass" line for either liquid or vapor, for a certain section of main in case of a leak, so that the defective section can be repaired without stopping the refrigeration in such section. Insulated wires are also laid in the conduits, and to each customer, to supply electric current from the central station, for the operation of the automatic valves controlling the supply of ammonia to the refrigerators.

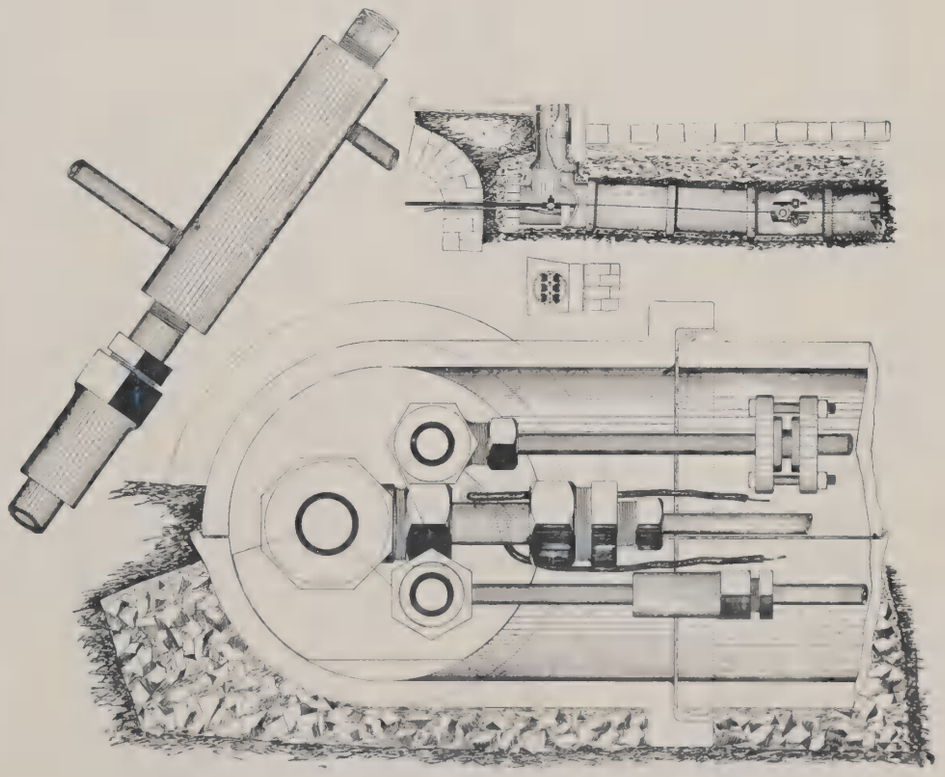
In each refrigerator a suitable amount of piping is placed in any proper and convenient position. This piping is called the "expansion coil," and is connected at one end to the branch "liquid line," and at the other end to the branch from the "vapor line."

A very small pressure (about four or five pounds) exists in the expansion coil and the return main, while the liquid ammonia in the liquid line and its branches, is under pressure up to its junction with the expansion coil. At the point of this junction, which is just at the wall of the refrigerator, is placed a special form of valve, which can be worked either by hand or by an electric device controlled by a thermostat placed in the box and connected by wires.

This valve, when opened, allows a small trickle of ammonia to enter the expansion coil. This liquid ammonia, when relieved of pressure, boils, or vaporizes, at about twenty-five degrees below zero. Hence it cools to this low temperature the piping of the expansion coil, producing a thick white frost on its surface, refrigerating the box to any desired temperature, according to the amount of ammonia allowed to flow into the coil in a given period of time.

Cooling a box, of course, means simply taking heat out of it. The heat thus taken out really boils the ammonia from a liquid to a gas, just as the heat of a fire boils water into steam, the only difference being that anhydrous ammonia, when under but slight pressure, boils at any temperature above twenty-five or thirty degrees below zero, while water boils at 212 degrees above zero.

The amount of piping in the box is so adjusted to the size of the box and the temperature desired, that the liquid all evaporates before leaving the box and has done all the work it is capable of doing. This gas then returns to the central station by the vapor main, where it is recondensed into a liquid and sent out again on its cooling mission.

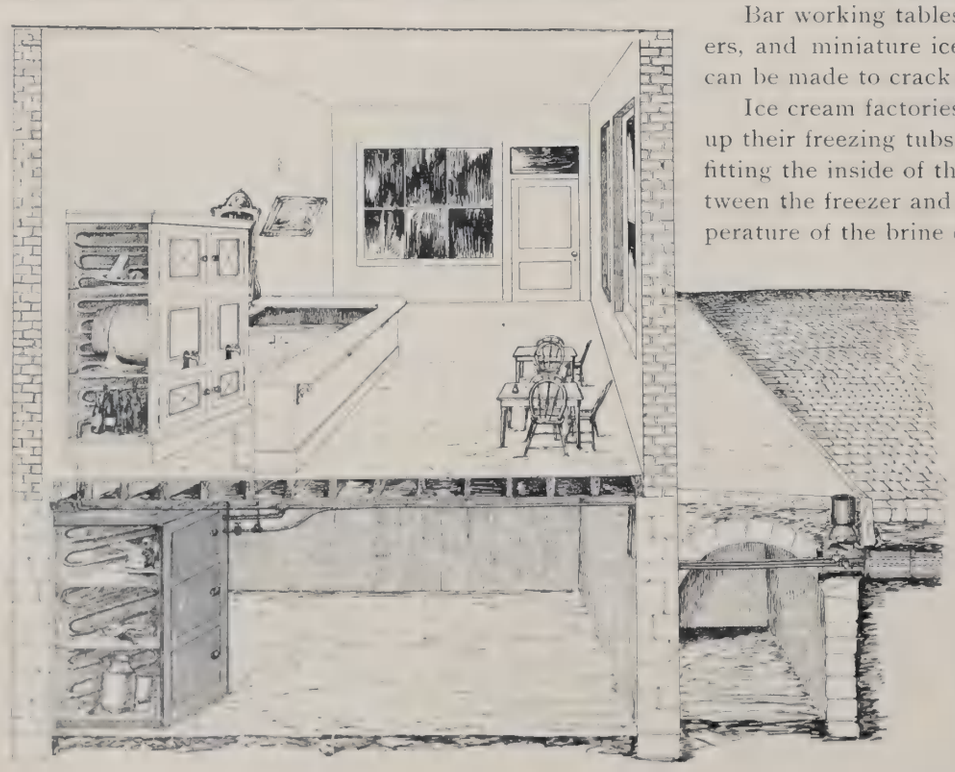


VIEWS OF CONDUIT, SHOWING PIPES AND CONNECTIONS INCLOSED.

It will be observed that no refrigerating work is done in the conduits or on the way to the customer. The pipes leading to and from each box are of the same temperature as the air, or of the gas, or water pipes in the vicinity. The entire cooling power of the central station, therefore, is delivered only where it can be used and paid for—in the refrigerators of the customers.

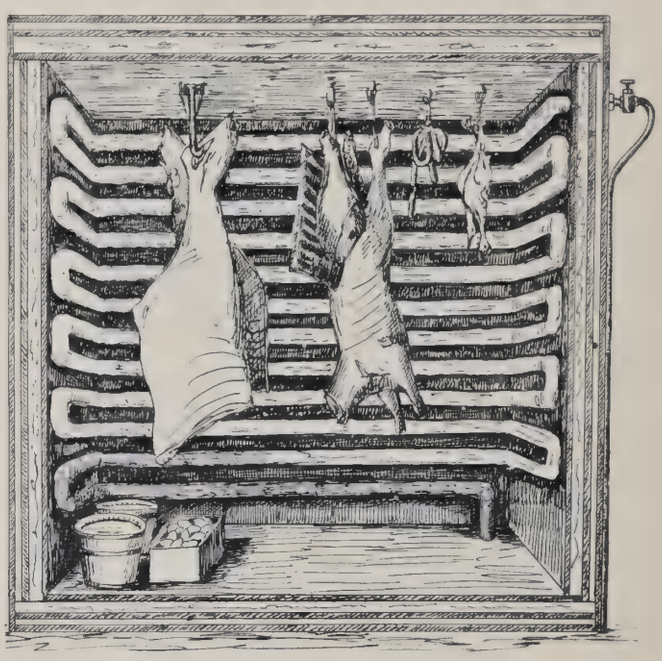
A walk along the line of the mains now in operation by the St. Louis Automatic Refrigerating Co., and a glance at the methods employed in supplying different kinds of service to its many customers, is extremely interesting to one familiar with mechanical refrigeration, and almost startling to the layman. Here a large butter box in a commission house is cooled to its contract temperature of forty-two degrees; a few doors away a butcher with a meat box at thirty-six degrees, the meat firm and dry as in a packing house; a block away is a large beer vault, the down-town storage room of one of the great breweries, with a temperature just the same as in their own vaults; three or four blocks further away, on one of the principal business streets, are numerous restaurants, hotels and saloons, showing great variety of service. In one large restaurant is a large box containing three compartments; in one of these compartments a temperature of thirty-seven degrees is maintained for meats and vegetables, etc.; in the other end, a temperature of just above freezing, for fish; and in the centre, a freezer, with a temperature of about fifteen degrees F., where meats, game or fish may be frozen and held for any length of time; absolutely nothing in the shape of food worth saving is spoiled and thrown away.

In one of the most prominent restaurants in the city, this company supplies a number of boxes at different temperatures for different classes of service. A new



INTERIOR VIEW, SHOWING ARRANGEMENT OF SERVICE SYSTEM.

feature at this place is a champagne cooler behind the bar, which contains inside two tanks filled with brine. The expansion coils are placed in the brine, and hold it at any desired temperature. Also, in the brine, are revolving castors made of galvanized iron, containing cases large enough for the reception of quart and small bottles of champagne. By this device the different brands can be kept separate, and are easily reached. The galvanized iron cases protect the labels, and the cold brine in immediate contact with the bottle cases of course renders



BUTCHER'S BOX, SHOWING ARRANGEMENT OF PIPING.

the wine either very cool, "just cool enough," or *frappe*, to suit the customer's taste. The act of the bartender in revolving the castors to pick out the required brand, circulates the brine sufficiently.

Bar working tables are also fitted with bottle coolers, and miniature ice tanks, in which sufficient ice can be made to crack up for mixed drinks.

Ice cream factories are supplied by simply fitting up their freezing tubs with a circular expansion coil, fitting the inside of the tub, and filling the space between the freezer and the tub with brine. The temperature of the brine can thus be nicely regulated.

It is especially noticeable that the customer is relieved of all care and labor in the management of his box. He has nothing to do but pay his bills for the temperature contracted for. It is also claimed by this company that his bills are less than he has to pay for ice refrigeration, and uniform from year to year. That he has at least one-third more available storage space in his box, as the coils occupy but little room, and that the space formerly occupied by ice can be used for his goods.

The company does not intend to confine itself to the various classes of service above noted. As an officer of the company remarked: "We intend to supply cooling power along our mains to any one who wants it, for any purpose." They are already entering into contracts for

cooling dining rooms in cafés and audience rooms. Water cooling for employés in large stores and manufactories, and for tenants in office blocks, cooling rooms for chocolates in candy factories, for preserving furs and woolen goods from moths, and in the manufacture of perfumes for wholesale druggists, are among the numerous classes of service for which contracts are being made.

The central station machinery used to operate this street system, is a modification of the type of refrigerating apparatus known as the absorption machine. The process consists essentially of separating, by heat, ammonia from its solution with water; the cooling and condensing of the gas in a surface condenser to liquid anhydrous ammonia; the use of this liquid ammonia in the street line as described, and the reception or absorption of the expanded gas from the return main back again into the water out of which it was originally driven, when it is again distilled, re-liquefied, and sent out into the mains.

A great amount of developing work had to be done to produce a machine capable of taking care of pipe line work, as the refrigerating load, as may well be imagined, is very unsteady, unlike ice making, or brewery work, where the load is constant.

In pipe line work the variations in rate of the refrigerating load are often from seventy per cent above to fifty per cent below the daily rate, inside of a very few minutes' time, yet with the machines used by this company the pressures on the liquid and vapor mains remain constant, without attention on the part of the engineer, the conditions at the factory automatically adjusting themselves to the irregular use of the liquid.

The St. Louis company are now increasing their plant by the addition of machinery that will give an increased capacity, equal to the melting of 100 tons of ice daily. The entire output of this added apparatus will be used in street pipe line work, which they now have in contract along their new mains.

Plans for a new 500-ton central station are now being made. They expect to commence work on this building and machinery in the fall.

A portion of their present capacity is used to refrigerate their cold storage warehouse, which adjoins their central station.

The Refrigerating Co. state with considerable pride, that although they have run their pipes into all sorts of buildings, upstairs and downstairs, through the dining rooms of hotels and restaurants, and the salesrooms of groceries and commission houses, they have never had an accident of any kind, and not a single leak, nor have they caused their customers, or the public, the slightest inconvenience. They also claim that their safety devices and system of operation is such that a serious accident, under any circumstances, is well nigh an impossibility.

Ultimately they expect to push their mains out into the residence part of the city, as they find the income to be expected in this direction is one which fully justifies the investment.

——On June 14 the main building of the Philadelphia Abattoir Co., Arch and Thirteenth sts., was destroyed by fire, together with the refrigerating houses containing valuable machinery and 1,000 carcasses of dressed beef and 10,000 green hides. During the progress of the fire one of the cold air condensers in the refrigerating house burst and an iron bolt struck a spectator in the head, inflicting probably mortal injuries.



NATURAL ICE NEWS.

——The National Ice Co., of New York, has filed a certificate of an increase of capital from $250,000 to $750,000.

——The Banner Ice Co. is a new firm this season at Toledo, and is composed of Alex. Motry and Wm. Schade.

——A new ice company at St. Paul, Minn., of which C. M. Douglas is the head, will commence operations at once.

——J. N. Briggs, of Coeyman's, N. Y., will build another large ice house this season in anticipation of next winter's crop.

——Star Ice Co., Selma, Alabama has built a larger brick house for storage of ice by car load. Stephan Childs also built one recently.

——The Belle Isle Ice Co., of Detroit, were able to harvest only about 12,000 at Pontiac, last winter, whereas their usual cut there is three or four times that quantity.

——The Gloninger's Springs Ice Co., Lebanon, Pa., was recently organized. Dr. A. B. Gloninger is President. The company propose to use Gloninger's springs, a short distance west of the city, and will erect a dam giving a water surface of ten acres.

——Ice shipping from the Kennebec in June was rather slow, and in marked contrast with the great rush of last year. The following companies have made shipments this season: The Knickerbockers at Smithtown and Chelsea, Great Falls, Independent; Clark & Chaplin, Cedar Grove, Berry, Haynes, Dewitt and Morse & Co. Much of the ice is sold under contract or by companies having houses on the river and retail routes in the large cities. Hardly any price can be quoted upon ice, as there is no demand to speak of. A prominent Augusta ice man says there is no end to the law suits growing out of last year's speculations, and there will be litigation for years to come; one New York company sank over $1,000,000.

ICE HOUSE AND FACTORY FIRES.

——Fay's ice house, Peoria, Ill., was destroyed by fire July 5.

——The Rome (Ga.) ice factory was burned a few days ago; loss, $8,000; no insurance.

——The ice factory building at Santa Fe, N. M., was burned June 7; contents uninjured.

——The ice house of the Alton (Ill.) Coal and Ice Co., with 700 tons of ice was destroyed by fire July 6.

——B. M. Prescott's ice house and stable, Franklin Falls, N. H., were burned June 20; net loss, $1,500.

——The Knickerbocker ice house at Farmingdale, Me., was burned May 31; loss, $37,000; insurance, $10,000.

——The Fond du Lac (Wis.) Ice Co. lost their store house, and 2,000 tons of ice by fire recently; loss, $3,500; no insurance.

——E. M. Bond's ice houses at Franklin Falls, N. H., were burned June 20, and 5,000 tons of ice lost; loss, $20,000; insurance, $3,000.

——Shafer & Son's ice house, Colvin avenue, Albany, containing 18,000 tons of ice, was burned June 30. Insurance $4,000 on ice house only.

——During a recent thunder storm, the ice houses of McGinnis & Boyle, at Camp Lake, Wis., were struck by lightning and burned; net loss, $10,000.

——The ice-houses of Barker & Wight, at Devil's Lake, near Adrian, Mich., were destroyed by fire just after the work of filling had been completed. Their loss was some $8,000.

——Wilbur's ice houses at Bath, N. Y., near Troy, were burned at the opening of the season, entailing a loss of $10,000. The property was owned by a New Jersey firm, the recent purchasers.

——On June 13 the Knickerbocker ice houses at the mouth of Fox river in Oshkosh, Wis., were set afire and destroyed, with a quantity of ice. The loss is about $5,000. The headquarters of the company are in Chicago.

——The ice houses of Kinney, Little & Force, Struble's Lake, N. J., were struck by lightning during a June thunder storm, and burned. The buildings contained 12,000 tons of ice, owned by the John Hemerck Ice Co., in Philadelphia, and valued at $15,000, on which there was $10,000 of insurance, with $7,000 insurance on the buildings.

——No ice was harvested by Aish Bros. & Raab, of Chicago, at Oswego, Ill., last winter, the season being unfavorable for a crop, and their twenty-four houses there stood empty. Some weeks ago, however, a passing locomotive set fire to the buildings and thirteen of the twenty-four, with much valuable machinery, were destroyed. Loss about $11,000.



[*Written for* ICE AND REFRIGERATION.]

ICE MAKING.

THE SUBJECT OF ICE MAKING TREATED BY A PRACTICAL MAN—COST OF PRODUCING ICE—IMPORTANT FACTS AND STATISTICS.

BY CHARLES W. BIESE.

The value of ice making machines has assumed a new importance since it has been shown that they may be worked to an economical advantage in some sections, even where natural ice is not difficult to obtain. But aside from any question of competition with natural ice in temperate climates, the subject, how to produce and maintain a low temperature, is of great interest in places where the requisite quantity of ice would be too cumbersome, and where a refrigerating machine could be easily accommodated. For several years past, on account of very open winters, the manufacture of ice has been brought to the front as a very important factor in the business transactions of this country. One of its main features is refrigeration for shipping purposes, of meats, fruits, vegetables and other perishable goods.

The natural ice which has been stored for several years past in the United States and Canada has not been sufficient by nearly 100 per cent to supply the wants of the people; and if it had not been for the ice factories, both north and south, a great calamity would have obtained throughout the country, as the use of ice is not any longer a luxury, but a necessity of the highest importance; in fact, in our age and time we could not do without refrigeration and ice.

HISTORICAL.

By your request I will endeavor to give a brief history of the manufacture of ice and of ice making machines. As far back as 1824, Vallance; 1834, Perkins, and 1850 to 1852, Twining, had made experiments to produce ice by mechanical means. A machine was erected by Twining in Cleveland, Ohio, in the year 1855, in which sulphuric ether was used as the agent, and produced about a ton of ice per day. Little progress, however, was made until 1858 to 1860, when Carrè, of France, invented his ammonia absorption machine. It took a number of years to perfect it so that it was able to produce a sensation at the Paris exposition of 1867. It was introduced in this country at New Orleans. In Germany the establishments of Oskar Kropff, at Nordhausen, and of Vaas & Littman, at Halle on the Saale, interested themselves in the machine; made improvements in different parts, and introduced it to considerable degree into large industries. Even in this country it was introduced in 1876 at the Centennial exposition.

In the United States the Carrè system was improved by J. M. Beath, who established factories in New Orleans, Atlanta, Chattanooga, Nashville, San Francisco and other places, and operated them with success. A small ice machine (three tons capacity), manufactured by Vaas & Littman, at Halle, was in operation at Rome, Ga., for a number of years, but has since been abandoned. Other machines of no importance, partly imitating the Carrè system, were put in operation in the United States after 1867, but were never heard of beyond their locality.

In former days all ice machines, which were considered of practical utility, were grouped under two great classes: Those which utilize the lowering of temperature that accompanies the rapid expansion of a compressed gas; and those which make use of the like thermal effect that results from the volatilization of some liquid.

In 1849, Gorrie constructed a machine, which, however, was unsatisfactory in its action, probably because the compressed air was not sufficiently cooled and dried. More efficient were Kirk's machine (patented 1863), and Windhausen's (1870), one of which at the Vienna exhibition produced thirty hundredweights of ice per hour at the cost of $1 per hundredweight. In England it appeared under the name of the Stanley-Reece machine, which, since the transfer of the patents, is known also in this country under the name of the Pontifex machine. In the United States the absorption system found its principal promoters in Rankin, De Coppets and Stratton.

In 1874 and 1875, Pictet, in Geneva, Switzerland, proposed anhydrous sulphurous oxide (or acid) as an agent for cooling in the industrial arts. At about the same time, Boyle, in America, and Linde, in Germany, suggested anhydrous ammonia. All three use compressing pumps, which force the gas, after having performed its cooling work, into condensers, where it is reliquefied by means of cold water. In addition, a large number of other substances were tried experimentally, as, for instance, methylic ether, carbonic acid, chloride of methyl, shymogene, etc.

I have referred to Twining, who built his ether machine in 1855, which represented in every respect the system of the compression machine, so that he is enti-

tled to be called the inventor of that system. And Carrè is entitled to be called the inventor of the absorption system. At the present time all other machines have taken the background, and left the compression machines and absorption machines in possession of the field. The compression machine uses "anhydrous ammonia" (or ammoniacal gas entirely deprived of moisture), or "sulphurous oxide," whereas the absorption machine uses the "aqua ammonia."

NOTES ON THE SYSTEMS.

A few points of interest may here be mentioned, bearing upon both systems alike. I refer to the principles of operation. The action of all refrigerating machines depends upon well defined natural laws that govern in all cases, no matter what type of apparatus or machine is used, the principle being the same in all, though processes may slightly vary, the properties of the particular agent and manner of its use affecting, of course, the efficiency, or economic results, obtained. A liquid passing into the gaseous state, or when converted into a vapor, carries away a definite amount of heat from the objects by which it is surrounded; and its capacity for storing heat under these conditions is called its latent heat of evaporation. The unit employed to measure the amount is called a thermal unit, and refers to an equivalent of one pound of water raised or lowered 1 deg. F. The work done in cooling is called negative heat, in contradistinction to heating or positive. The same laws apply to both. One pound of ice in melting requires the application of 142 units of heat, and in round numbers, the evaporation of one pound of liquid ammonia is equivalent to the cooling work done by the melting of four pounds of ice into water at 32 deg. Ammonia will boil, or evaporate, when exposed to the atmosphere at a temperature of 28½ deg. F. below zero, or 240½ deg. lower than the boiling point of water under same conditions.

COMPRESSION OR MECHANICAL MACHINES.

To illustrate the compression system, the processes consist of a cycle or round of three operations following each other in rotation, and which are practically the same in all the refrigerating machines now in use.

The gas is compressed to a pressure (varying in the case of ammonia from 125 to 175 pounds per square inch, and depending upon the condensing water used); this is done by large compression pumps or engines. During the compression, heat is developed to the amount of pressure exerted upon the gas, or to the relative volume to which it has been reduced.

Expressed in popular parlance, heat is squeezed out of the gas, and can then be carried away by the condensing water.

CONDENSATION.

The heat developed in the above operation is withdrawn from the compressed gas by forcing it through coils of pipe, while said coils are in contact with cold water or open air, the heat being transferred to the water surrounding the coils if in closed tanks or dripping over the pipes when exposed to open air. When this point is reached the gas is ready to assume the liquid condition, and in so doing it gives off additional heat to the surrounding water.

EXPANSION.

The liquefied gas thus obtained is allowed to enter coils of pipe so placed, that the substances to be cooled (air, water, brine, etc.), can be brought into contact with them, the pressure in the interior of these coils being maintained at a lower point than that required for retaining the gas in the liquid state.

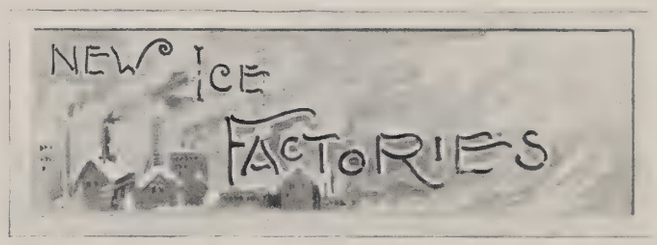
The liquefied gas upon entering said coils re-expands and extracts from the pipes and the substances surrounding the pipes the same quantity of heat that was previously given up by the gas to the water or air used during the period of condensation and liquefaction—the gas having performed in this last operation its refrigerating work, is now ready to repeat the same cycle of operations.

In order to render the operation continuous, these three parts are connected together, the gas passing through them in the order named.

The gas is drawn from the expansion coils by the pumps at a pressure varying from 10 to 15 pounds above that of the atmosphere, and is then forced into the condensing coils where a pressure of 125 to 175 pounds per square inch usually exists; here liquefaction takes place, and the resulting liquefied gas is allowed to flow to a stop cock or a small valve having a minute opening which separates the compression from the expansion side of the plant.

Various modifications of the above, as well as auxiliary processes, have been introduced by patentees and builders in their machines; but the principles above described are the same in all compression machines, the difference being in their application.

(TO BE CONTINUED.)



As suggested elsewhere, the Southern ice trade, based on the cut of Northern lakes and rivers, has become a thing of the past. A decade ago the statement that the time would come when the enormous supplies shipped from the North, claimed to be limited only by the demand, would be deprived of a market in the South because of the competition of the ice machine, would have been met with ridicule. Yet, as a matter of fact, the vast proportion of all the ice used in Southern cities, especially those not located on the great inland waterways, is of local manufacture. Wherever the demand for ice exists—and the demand is daily broadening—there the demand is met with an abundant supply from the local ice factory.

As an indication of the growth of the industry, and as corroborative of this statement by ICE AND REFRIGERATION, we quote from the *Tradesman*, which, in a brief study on "Ice Factories in Southern States," finds that in the first quarter of 1889, there were established twenty-four ice making plants in the Southern states; in 1890, during the same period, twenty-seven establishments were put in operation; while in 1891, with the quarter not quite finished, the erection of thirty-nine ice factories was reported; showing that in 1891 the record of the past has been left far behind. In Texas, alone, for the whole season, 100 ice factories are reported

as building. That is probably an exaggeration, though the actual number is large.

In the Northern states the increase of factories is naturally much slower, since ordinarily nature may there be relied upon to furnish all supplies the trade demands; yet even in these states the growth of the industry of making ice by mechanical means is quite marked: and is, at least, of sufficient importance to deserve the careful attention of the natural ice dealers. The recent two unsatisfactory seasons have done much to turn the attention of ice dealers from their cutting fields to the ice machine, especially as spring came steadily on, with ice houses but partially filled and the cut not quite up to the mark of first-class in quality. Interest accounts on investments in cutting rights, store houses and machinery, ran right along, notwithstanding the mercury stood day after day, and week after week, above the crop making mark, with a few aggravating exceptions, and no ice formed. No wonder that many a local dealer, to whom continued mild weather meant loss of income, began to look at the ice machine he had formerly snubbed, to see what there was "in it anyhow." It's the old story of pity becoming endurance and ending in embracing, as Simpkins said of his wife who had an unnecessary crook to her nose.

From the very nature of things, in recording new ventures in the ice business, by far the greater part of the space so devoted in ICE AND REFRIGERATION, must be given to new ice factories. These ventures, of course, are more frequently reported than the erection of new houses for the storage of natural ice, and particularly so during the summer months. It must not, therefore, be assumed that it is the purpose of ICE AND REFRIGERATION to boom the manufactured ice at the expense of the natural article. Such is not the purpose of this review, which aims to represent and champion the interests of the entire ice trade of the country. On the other hand, a complete monthly report of new ice factories in contemplation, in process of erection, or completed, cannot but be of immense value to the natural ice dealer. Such knowledge will keep him in touch with every new claim made for the new product; every new advance made by it; every encroachment by it upon his territory, —in short, every step taken by it which can in any manner affect his business, directly or indirectly. It is unnecessary, we apprehend, to comment on the value of such knowledge to every man in the trade, whether he handles the natural or manufactured product. The most miserable of all men is he, who, apprehending a danger or dreading a change, deliberately closes his eyes and refuses to see or admit that which he may not desire to see, but must if he would protect himself or be "in the swim": or who deliberately neglects to keep himself posted in every way and eventually gives way to a more energetic or better posted man than himself.

Our present record of new factories is not in every respect as complete as we could wish, but it is a record of representative events in construction in all parts of the country. Readers of ICE AND REFRIGERATION are invited to send us items for this department. A postal card will usually be sufficient for the main facts, while fuller details may be sent in by letter post.

New ice factories are talked of at Elk Garden, Va.; Elberton, Ga.; Arkansas City, Ark.; Norfolk, Va.; Chattanooga, Tenn.; and increase of capacity by People's Ice Manufacturing Co., Birmingham, Ala., and Griffin (Ga.) Ice Co.

ALABAMA.

Bessemer—The Meumann ice factory has begun making ice.

Birmingham—The People's Ice Manufacturing Co. will put in a 60-ton machine.

Bridgeport—The Bridgeport Ice and Electric Co. has invested $23,000 in an ice factory, to be ready for operations by August 1. The company's capital is $60,000.

Florence—The report of a new ice factory erecting at Florence, Ala., is an error; but the existing factory is enlarging its capacity with all new improvements, from five to eight tons, which will supply all demands.

Florence—The Sweetwater Ice & Coal Co. is a new ice plant, and uses the York machine.

Gadsden—Mr. Robt. Lucas has constructed a 10-ton ice plant of his own design, and is engaged in ice manufacturing, in conjunction with Mr. G. H. Cornelson, a capitalist, of Orangeburg, S. C.

Jacksonville—The Southern Ice & Cold Storage Co., of Tredegar, near here, which is the postoffice town, with capital of $12,000, has let the contract for machinery and begun work on the buildings.

Mobile—Consumers' Ice Co. put its first product on the market in June.

New Decatur—The ice factory has enlarged its capacity for this season.

Opelika—W. J. Carlisle has made a contract with the machinists for the erection of an ice factory.

Talladega—The Talladega Ice Co. will increase its capacity by putting in new machinery.

ARKANSAS.

Camden—The Arkansas & Texas Consolidated Ice & Coal Co. have recently started a plant. This extensive artificial ice manufacturing concern now has plants under its control at Vernon and Marshall, Tex., and Pine Bluff and Camden, Ark. Mr. J. Hicks, the enterprising president, is a pioneer and ardent champion of artificial ice making, and one of its most successful promoters in the South.

Helena—Helena Ice Co. recently augmented their producing capacity by the addition of an ice machine constructed for them by the Richmond Ice Machine Co., Richmond, Va.

Hot Springs—The Valley Ice Co. has been incorporated; capital, $55,000.

Jonesboro—Messrs. Dixon & Ware, are the proprietors of a new ice factory, the first inaugurated here, the machinery for which was supplied from St. Louis.

CALIFORNIA.

Azusa—An ice factory will soon be in operation.

COLORADO.

Colorado Springs—The Union Ice Co. are building an ice factory and cold storage house. They will use a ten-ton Frick Co. machine.

Lake George—The Lake George Town Land & Ice Co. has filed articles of incorporation. The incorporators are George W. Frost, of Florissant, Colo.; William M. Davidson, of Denver, Colo., and Joseph A. Wallis, of Beverly, Mass.; the capital stock, $300,000.

DELAWARE.

Milford—New ice factory has been started up by Geo. S. Grier.

FLORIDA.

Fernandina—The St. Augustine Ice Manufacturing Co. is erecting a 12-ton ice factory at Fernandina, Fla.

Tarpon Springs—An ice factory has recently been constructed and started by Messrs. W. S. Griffith & Co., of Philadelphia.

GEORGIA.

Americus—Now boasts of two ice factories, the Americus Refrigerating Co. having recently put in a plant constructed for them by the Holgate Ice Machine Co.

Columbus—A new 10-ton ice factory is about ready for ice making.

Griffin—The ice factory will increase its capacity.

La Grange—The new ice factory has just been completed.

Macon—The new ice works and cold storage house of the Planters' Oil Mill Co. has begun operations.

Rome—A stock company has been organized to erect an ice factory.

Tallapoosa—The Tallapoosa Ice Manufacturing Co. is erecting a factory at Tallapoosa, Ga.

Tallapoosa—An 8-ton ice factory is being erected.

ILLINOIS.

Murphysboro—The Murphysboro Brewing and Artificial Ice Co. are building an ice factory.

Waukegan—The Southern Ice Co. has been incorporated at Waukegan, Ill.; capital stock, $100,000; to manufacture ice; incorporators, R. Scott, W. E. Winn, J. J. Metzger.

INDIANA.

Asheville—Messrs. Graham & Baker have just started their ice factory.

Edinburg—Edinburg Ice Co. have their new plant in operation, machinery for which was supplied by the Southern Ice Machine Co., of Chattanooga, Tenn., and the ammonia by the National Ammonia Co.

Greenfield—Greenfield Ice Co. have just started a new plant put up by the York Manufacturing Co.

Muncie—The new ice plant of the Muncie Ice Co., constructed by the Southern Ice Machine Co., of Chattanooga, has just been put in operation, with ammonia from the National Ammonia Co.

Seymour—Seymour Ice Co. operates a new factory, for which machinery was supplied recently.

Terre Haute—The Terre Haute Brewing Co. have altered their ice factory considerably, introducing the Ball absorber, made in St. Louis. The capacity has been increased to thirty-five tons daily.

KANSAS.

Fredonia—Fredonia Water Co. is the owner and operator of an ice plant constructed by Fuller, Osborne & Co., Chicago.

Kansas City—The Kansas City Ice & Storage Co., East St. Louis, has incorporated to manufacture and deal in ice and conduct a cold storage business; capital stock, $50,000; incorporators, H. E. Mills, Herman Rolf and Windsor D. Bigelow.

Leavenworth—Ryan & Richardson own and operate a new ice factory just completed for them by the York Manufacturing Co., York, Pa.

Manhattan—Smallwood & Co. have just started their ice factory, with Hercules machinery.

Parsons—Has an ice factory, the promoters of which are the stockholders of the Crystal Ice Co., Wichita.

KENTUCKY.

Middlesborough—The Overbeck Brewery, Cold Storage & Ice Manufacturing Co. has begun making ice for the regular trade. They are using a Linde compression machine, twenty-eight tons capacity.

Mt. Sterling—J. M. Pickrell, proprietor of Arctic Ice Factory, will build new factory at once three times his present capacity.

LOUISIANA.

Thibodeaux—The ice factory has doubled its capacity for this season's business.

MISSISSIPPI.

Grenada—The new ice factory began making ice about June 1, and is having a demand for their entire production.

MISSOURI.

Kansas City—Kansas City Ice & Cold Storage Co. is a new concern in the ice manufacturing business, which has secured part of the premises of the old Morrison Packing Co., upon which their ice factory is located and conducted.

Sedalia—The Sedalia Ice Manufacturing & Cold Storage Co. has been incorporated; capital, $30,000; to manufacture ice, store fruits, etc.

St. Joseph—St. Joseph Artesian Ice & Cold Storage Co. have just put in a new plant.

St. Louis—The first charge of ammonia for the new large ice machine of the Carondelet Electric Light & Power Co., was put in by the Herf & Frerichs Chemical Co.

Webb City—Webb City Ice & Storage Co. has been incorporated with a capital of $35,000; to operate an ice plant and provide cold storage.

NEW JERSEY.

Cape May—The Knickerbocker Ice Co., of Philadelphia, has just completed an ice factory in which a large Hercules Iron Works plant has been installed, and machine started with "prime charge" of ammonia furnished by the National Ammonia Co. This company also has an artificial ice plant at Atlantic City, and seems to be gradually taking up the business of ice manufacturing.

Gloucester—The Gloucester Ice & Brewing Co. has been incorporated; capital stock, $50,000.

Jersey City—Economy Refrigerating Co., of Brooklyn, have just completed and started a plant of their construction in the sugar refinery of Matthiessen-Wiechers Sugar Refining Co.

Newark—The Krueger Co. will double the capacity of their ice making plant the coming winter.

NEW MEXICO.

Gallup—The Gallup Beer & Ice Co. has been incorporated; capital stock, $1,400.

NEW YORK.

Brooklyn—An ice factory of large producing capacity, controlled by a Frick machine, first charge of ammonia supplied by the National Ammonia Co., has just commenced business; owned by the Brooklyn Consumers' Ice Co.

NORTH CAROLINA.

New Berne—The New Berne Ice Co. has been incorporated with William Dunn, president; James Redmond, vice-president, and Charles Reizenstein, secretary, to establish an ice factory. The capital stock is $15,000. Machinery was purchased early in June.

Raleigh—Messrs. J. E. Lord & Co., a new firm in the ice manufacturing business, operate a plant built for them by the York Manufacturing Co., York, Pa., with ammonia supplied by the National Ammonia Co.

Winston-Salem—A $30,000 ice factory is to be erected.

OHIO.

Akron—The Klages Coal & Ice Co. are going to erect a plant to manufacture ice.

Circleville—H. J. Bennett is thinking of buying a 6-ton ice machine.

OREGON.

East Portland—This place is to have an ice factory, the site for which has already been secured, and the plant ordered. An eastern capitalist is interested in the matter jointly with the Portland Artificial Ice Co., the Portland Ice Works and the Northwest Cold Storage & Ice Co. The factory is to have a capacity of producing twelve tons per day, and is intended to supply the East Side, and save the trouble and expense of hauling ice across the river. The *Oregonian* says: "Notwithstanding that the natural ice crop was a failure this year, there is every prospect of there being plenty of ice here, and there is every assurance that there will be no change in the price."

Portland—A new ice factory is being built at East Portland, Ore., by the Consumers' Ice Co. It is located at corner of Third and Pacific streets, and will have a capacity of twenty-five tons of ice per day. The ice machine is of new design, using the Johnson compound ammonia compressor, manufactured by Johnson, McCarthy & Johnson, Portland, Ore. They expect to be in operation middle of July.

PENNSYLVANIA.

Chester—The Consumers' Ice Co. are boring an artesian well.

Germantown—The Germantown Ice Manufacturing Co. has doubled the capacity of their works.

TENNESSEE.

Bristol—Diamond Ice Co. have recently commenced to put their product on the market.

Chattanooga—The Southern Ice & Cold Storage Co. will, it is reported, erect an ice factory and cotton seed oil mill at Jonesville, La., a $25,000 stock company having been organized to operate same.

Cumberland Gap—The comforts of this delightful resort are enhanced by good ice in abundant quantity, from the new ice factory of the Cumberland Gap Ice Co.

Humboldt—Messrs. Bear Bros. are the owners and operators of a new ice factory.

Morristown—The new ice factory is rapidly approaching completion. It will have cold storage rooms attached.

Nashville—Messrs. Meadors & Osgood have just added an extensive ice factory to their business as fish dealers, for which machinery has been supplied by the Hercules Iron Works and ammonia by the National Ammonia Co.

Tullahoma—W. H. McLemore is lessee of the Tullahoma ice factory this season, and has the same in successful and profitable operation.

TEXAS.

Austin—G. B. Zimpleman & Co. will establish a canning factory in connection with their ice making plant.

Bastrop—J. M. Kennedy is erecting an ice factory.

Beeville—The ice factory has begun making ice.

Belton—An ice factory is building for Baker & Vickery.

Bonham—Messrs. Clendennen & Dodd have their new factory in full sway.

Dallas—The new ice machinery of the Dallas Ice Factory & Cold Storage Co. has just received its first charge of ammonia from Herf & Frerichs Chemical Co.

Ennis—The Ennis Ice, Water & Power Co. has been incorporated with $75,000 capital. The ice plant and water works are being pushed rapidly toward completion, and will soon be in operation.

Honey Grove—Honey Grove Ice & Electric Co. has its new ice factory in operation. Machine built by Ft. Worth Iron Works.

Mexia—Mexia Ice & Mechanical Engineering Co. has recently started its new ice plant constructed for them by Mr. Edgar S. Taylor.

Orange—The Orange ice factory has begun ice making. Daily capacity, twenty tons.

San Antonio—Mr. J. C. Ward has sold his ice factory, machinery his own design, put up by himself this spring, to Mr. H. C. Sprinkler.

Wichita Falls—A. Newby is putting fine ice on the market from his new plant.

Yoakum—The new ice factory just put in operation at this point was built by Messrs. Harris, Anderson & Co., of Corpus Christi.

VIRGINIA.

Buena Vista—A joint stock company has been organized to erect an ice factory.

Buena Vista—J. A. Gleason is organizing a company to erect an ice factory at Buena Vista.

Manchester—Manchester Transparent Ice Co., with a machine from the Richmond Ice Machine Co. and ammonia from the National Ammonia Co., has commenced work.

Newport News—The Richmond Ice Machine Co. has recently completed the plant of the Crystal Ice and Refrigerating Co., and the ammonia for "prime charge" has been furnished by the National Ammonia Co. The product of the factory has just been placed on the market.

Norfolk—George Riddick and others, of Anderson, Ind., have organized the Hygeia Ice Co., and will erect an ice factory and sink artesian wells for water supply. Capacity of factory to be 60 to 90 tons per day.

Roanoke—The Diamond Ice Co. has organized as the Roanoke Ice Co., and has put in new machinery to enlarge the plant. G. T. Ingersoll is president, and J. T. Engleby, secretary.

Wytheville—Wytheville Ice & Dairy Co. have just commenced to operate with a Frick machine, for which first charge of ammonia has been supplied by the National Ammonia Co.

WISCONSIN.

Waukesha—The Waukesha Pure Ice Co., of Waukesha, Wis., has been incorporated; main office at Chicago, to manufacture ice of Waukesha Spring water; capital stock, $100,000: incorporators, Max M. Simon, S. B. Fleming and John A. Gutt.

ICE MAKING IN THE EAST INDIES A HUNDRED YEARS AGO.

John Lloyd Williams, Esq., who lived in the East Indies about a hundred years ago, gave the following description of making ice in those parts, in a paper read before the Royal Philosophical Society of England, about that time. More particularly he describes an ice making plant at Seerone, near Benares, as follows:

A space of ground of about four acres, nearly level, is divided into square plats from four to five feet wide. The borders are raised by earth taken from the surface of the plat, to about four inches; the cavities are filled up with dry straw, or sugar cane haum, laid smooth, on which are placed as many broad, shallow pans of unglazed earth as the spaces will hold. These pans are so extremely porous that their outsides become moist the instant water is put into them. They are smeared with butter on the inside to prevent the ice from adhering to them; and this it is necessary to repeat every three or four days. It would otherwise be impossible to remove the ice without either breaking the vessel, or spending more time in effecting it than could be afforded, where so much is to be done in so short a time. In the afternoon these pans are all filled with water by persons who walk along the borders or ridges. About five o'clock in the morning they begin to remove the ice from the pans; which is done by striking an iron hook into the center of it, and by that means breaking it into several pieces. If the pans have been many days without smearing, and it happens that the whole of the water is frozen, it is almost impossible to extract the ice without breaking the pans. The number of pans exposed at one time is computed at about 100,000: and there are employed in filling them with water in the evenings and taking out the ice in the mornings, about 300 men, women and children. The water is taken from a well contiguous to the spot. New vessels, being most porous, answer best.

It is necessary that the straw be dry; when it becomes wet, as it frequently does by accident, it is removed and replaced. I have observed water which had been boiled freeze in a China plate, yet, having frequently placed a China plate with well water among the unglazed pans on the straw beds, I found that when the latter had a considerable thickness of ice on them, the China plate had none. I have also wetted the straw of some of the plates, and always found it prevented the formation of ice. The air is generally very still when much ice is formed; a gentle wind usually prevails from the southwestward about daylight. I had a thermometer among the ice pans, during the season of making ice, with its bulb placed on the straw and another hung on a pole, five feet and a half above the ground; and commonly observed that when ice was formed and the thermometer on the straw was from 37 to 42 deg., that on the pole would stand about four degrees higher; but, if there was any wind, so as to prevent freezing, both the thermometers would agree.

April 30, 1792, the thermometer in the shade being at 95 degrees, some water was taken up from a well sixty feet deep, and the thermometer being immersed in it, its temperature was found to be 74 degrees. This water was then poured into four pots or pans, similar to those already mentioned as being employed in the process for making ice. They were also similar to each other in size and construction, except that two of them were new and unglazed, and the two others old, with their pores closed, so that no moisture could pass through them. These pots were then exposed to a hot westerly wind, in the shade, for the space of three hours, viz., from two o'clock in the afternoon till five. Upon examining them at that time, the water in the old pots was found to be at 84 degrees, and that in the new or porous ones at 68. After remaining in that situation one hour longer, the water in the old pots rose to 88 degrees, while that in the new ones continued at 68.

May 1, at two o'clock in the afternoon, the thermometer then being in the sun 110 degrees, and in the shade at 100, the experiment was repeated, with the same pots as before. After being filled with well water, they were exposed for four hours, viz., from two o'clock till six, to a hot wind; the water in the old pots was then found to be at 97 degrees, that in the new ones at 68.

The foregoing observations on the frigorific effect of evaporation from porous vessels will, perhaps, account, in some measure, for ice being formed when the thermometer in the air is above the freezing point. And the power of evaporation in generating cold may be further elucidated by the following observations on the effects produced by its means in our houses:

May 16, 1792, at two in the afternoon, the thermometer,
in the sun, with a hot westerly wind, rose to.... 118 degrees
The thermometer in the shade, but exposed to the
hot wind..... 110 degrees
Ditto, in the house, which was kept cool by tatties*.. 87 degrees
June 7, Thermometer in the sun..... 113 degrees
Ditto in the shade and hot wind..... 104 degrees
Ditto in the house, cooled by tatties..... 83 degrees

ONLY A FABLE.

A penguin, who observed an Arctic explorer in the act of freezing to death, remarked to a very fat auk at her side that it seemed strange in these days of refrigerating and ice machine that men should travel so far to freeze themselves.

"Not so strange," answered the auk, "they seek the bubble reputation even in the cannon's mouth."

"But here are no cannon," returned the penguin.

"Who said there were?" retorted the auk, tartly, as she dived for a crab, leaving the penguin wrestling with the metaphysical problem.

It will be observed that the bird which devoted its mind to abstract research was the one which went supperless to roost. Business is business. —*New York Sun.*

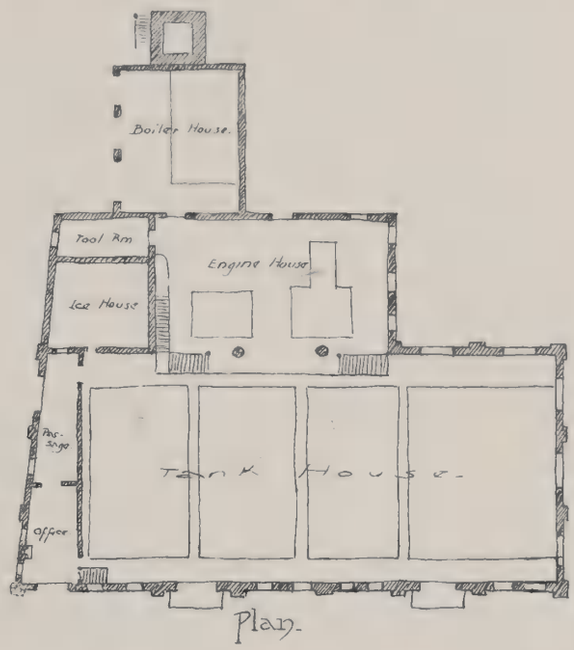
*Tatties are a kind of a mat made of fresh green bushes, or long roots, like snake root: they are affixed to the door or window frames, and kept constantly sprinkled with water. The degree of cold produced by this means is supposed to be in proportion to the heat of the wind which passes through them, as on that depends the quantity of evaporation. Mr. Williams also remarks that it was considered generally as necessary to the congelation of the water, that it should have been boiled, but as a matter of fact this was not necessary. This circumstance, however, would indicate that the inhabitants of India were well aware of the purifying power which boiling exerts on water.

A SOUTHERN ICE MAKING PLANT.

DESCRIPTION OF THE NEW ICE FACTORY OF THE ATLANTA ICE CO., AT ATLANTA, GA.—ITS PLANT, ETC.

No feature of the industrial growth of the new south is more conspicuous, aside from its iron interests, than the development of the "ice factory." This is true, not only by reason of the number of such establishments, their large production, and the great volume of capital invested in the business of making and handling ice, but because their constantly increasing numbers and capacity show that the south is rapidly advancing in accumulated wealth, and demanding ice as a luxury, as well as a necessary of life.

The growth of the business of the Atlanta Ice Co. confirms this thought as clearly, perhaps, as that of any plant in the south. The company was organized in 1887, with Mr. M. Benjamin as president of the corporation (which position he has ever since held), and started business with a maximum capacity of twenty tons daily. The demand, however, has long since outrun this capacity, and last fall and winter the company's plant was entirely rebuilt to give a larger capacity. An illustration of the new plant is given herewith.



Plan.



PREMISES OF THE ATLANTA ICE CO., ATLANTA, GA.

It is built of brick from plans and specifications furnished by Mr. A. S. Eichberg, architect, of Savannah, Ga. It is located upon the main line of the Georgia Central railroad, in west end, bordering on the corporate limits of the city. The site contains about three acres, of which the building itself occupies a space of 120×128 feet. The general appearance of the building is well shown by the illustration. It is ninety feet high. The tank room contains four freezing tanks, while the boiler room contains four boilers, aggregating 400 horse power. The compression system of ice machinery is employed, consisting of a fifteen-ton machine made by the Arctic Ice Machine Co., of Cleveland, and one of forty-five tons by John Featherstone's Sons, Chicago, making a total capacity of sixty tons daily. The entire plant is lighted by electricity, the company owning its own dynamo.

Altogether it is one of the most complete ice factories in the south, and one of which Mr. J. T. Eichberg, the superintendent, is particularly proud. Mr. Morris Benjamin, the president of the company, is also general manager of the Standard Ice Co., which company controls the output of three factories, having a total daily capacity of over 135 tons.

——At Washington, Ind., July 4, fire destroyed Summ's Bros. ice house. Loss about $7,000.

——At Greenbush, N. Y., July 6, fire broke out in the ice houses of Adam Bonaker. The buildings and their contents, about 5,000 tons of ice, were destroyed. The houses cost $8,000. The total loss was about $10,000 and the insurance $4,000.

THE LATE DAVID BOYLE.

It is with deep regret that we announce to the trade the death of Mr. David Boyle, the eminent inventor of ice and refrigerating machinery, which occurred at Mobile, Ala., on June 25. Mr. Boyle was on his way home from a business trip through Texas, and while in Mobile was stricken down with valvular disease of the heart, and died at the residence of Mr. A. Kling, president of the Consumers' Ice Co., after an illness of only a few days. He leaves a wife and daughter and two sons.

Probably no name is better known to the trade at large than that of David Boyle, and few have obtained as thorough a knowledge of the science of artificial ice making and refrigeration.

Mr. Boyle had devoted the last twenty-two years of his life to the study and improvement of this class of machinery, and with a success seldom attained by inventors. Surely the admiration and gratitude of the trade are due to the indefatigable inventor who spent his business capital and labored through long years to gain his object.



THE LATE DAVID BOYLE, CHICAGO.

Mr. Boyle was born on October 31, 1837, in Johnstone, a manufacturing town ten miles west of Glasgow, Scotland. November, 1859, he emigrated to Mobile, Ala. The end of the war found him at Demopolis, Ala., in which place during the summer of 1865, he made $8,000 selling iced lemonade! This was the foundation of Mr. Boyle's interest in ice machines.

He had heard of an ice machine located at Augusta, Ga., during the war, and that parties in New Orleans then had charge of it. In November, 1865, he went to see them, but found they were experimenting, and not prepared to sell machines. He returned to see them in 1886, and found they had just sold the first machine, of two tons capacity, for $30,000, to go to Shreveport. In view of such high prices, Mr. Boyle felt that he must give up the idea of a machine or find one of lower cost. For years he wrote and searched for information of another machine, but heard of none until the spring of 1869, when he found parties setting up a Vander Weyde machine in New Orleans. Receiving great promises of its success, he sold out his business and houses and lots to buy a machine, but it proved a complete failure.

Mr. Boyle was disappointed, and emigrated with his family to San Francisco, Cal., July, 1869. Here business was in a bad state. Finding a fine technical library in the Mechanics' Institute, he sought for information of ice machines, and finding the catalogue of Seibe & Co., London, he sent them the cash with the order for one of their smallest machines, to try it. A year passed without the machine being shipped, and Mr. Boyle employed an attorney in London and recovered his money.

While waiting for the machine he worked hard in the library, going through every volume likely to have a paragraph relating to ice machines. Balked in finding a satisfactory machine, he went to work and built two experimental machines, made valuable improvements and took out a patent in 1872. He moved to New Orleans with his family in November, 1872, and started to build a one-ton ice machine. On June 1, 1873, he landed at Jefferson, Tex., with his machine half done, a family to support, and only $175 funds left! After many trials the machine was finished, which, however, when tested, leaked like a sieve; the workmanship was defective—every joint of the machine had to be taken apart and remade. From sunrise to sunset seven days in the week he worked with the energy of desperation, but it was October before the machine turned out its first batch of ice. It proved a perfect success at last, but the ice season was over, he was taken sick, and was deep in debt.

After a winter of poverty and hardships to himself and family, the machine was started up in the spring of 1874, and produced its full quantity of the finest transparent ice. Accepting the offers of parties from the north, Mr. Boyle came to Quincy, Ill., in August, 1874, and built a couple of ice machines there for Texas. He went to Chicago, August, 1875, to find better facilities for building machines, and had since made Chicago his home.

The year 1876 was spent in study and in the experimental building of a small machine. In 1877 only two ice machines were finished. In 1878 five ice machines were built, also the first refrigerating machine, which was erected in the Bemis & McAvoy brewery, Chicago, and proved a complete success.

In 1879 a Boyle ice machine was erected at Atlanta on a new plan, making ice from distilled water, and so carefully was it designed that it proved a most perfect success, and has been the model after which all the Boyle ice machines have been built since then.

In 1884 the Boyle Ice Machine Co. was dissolved by limitation, and from that date Mr. Boyle continued in the business on his own account with remarkable success.

Personally, David Boyle was a man of sterling integrity, quick, sensitive and eager to succeed. His every thought was toward the advancement of the world's knowledge of the science of artificial ice making and refrigeration. His estate will fulfill all uncompleted contracts, and no doubt arrangements will soon be made for continuing the business.

ICE AND REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE AND THE TEXAS ICE MANUFACTURERS ASSOCIATION.

∴ JULY, 1891 ∴

SUBSCRIPTION PRICE, $2.00 PER ANNUM.

H. S. RICH & CO.
PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO.

206 Broadway, Cor. Fulton, NEW YORK.

Entered according to act of Congress, in the year 1891, by H. S. RICH & CO., in the Office of the Librarian of Congress, at Washington, D. C.

SEND IN YOUR SUBSCRIPTION.

Many thousand sample copies of this issue have been sent to people whom we think will be interested enough in its contents to subscribe. The attention of such is directed to the enclosed subscription blank, which please sign and return if you think ICE AND REFRIGERATION *will be of any service to you in your business.*

OUR INTRODUCTORY.

With this issue ICE AND REFRIGERATION makes its initial bow to the trade. We think that all will concur in the assertion that it more than fulfills every promise made for it. Its pages are crowded with valuable and practical facts and statistics, obtained from the most reliable sources, at great pains and expense. Included in these are contributions from many of the most eminent writers and experts in their various departments of labor in the great field which refrigeration in its various forms enters. Most of these we have elaborately illustrated with carefully prepared diagrams and views.

In its "lay-out," "make-up" and general typographical appearance we have stopped at nothing to make it the "best." In this particular it is unique! We had no model to copy from! And we have no hesitancy in declaring that in this respect there does not exist its peer in trade journalism. The standard of excellence we have established for ICE AND REFRIGERATION will in no particular be allowed to deteriorate. On the contrary, nothing in our power will be left undone to maintain its leadership in its chosen field.

We herewith extend to our already numerous friends and patrons our hearty thanks for, and sincere appreciation of, the many encouraging and substantial marks of favor they have showered on our new enterprise in a new and untried field. If earnest endeavor, indefatigable toil and a liberal policy will accomplish our purpose, we shall continue to merit your patronage and good will.

H. S. RICH & CO., *Publishers and Proprietors.*

OFFICIAL RECOGNITION.

The following is a copy of the original document making ICE AND REFRIGERATION the official organ of the Southern Ice Exchange:

ATLANTA, GA., April 16, 1891.

To the Members of the Southern Ice Exchange and the Trade:

This is to certify that the undersigned, appointed as a committee at the last meeting of the Southern Ice Exchange, February 25, 1891, and authorized to complete arrangements for the establishment of a successful trade paper representing the Exchange, have this day entered into an agreement with Messrs. H. S. Rich & Co., publishers of ICE AND REFRIGERATION, whereby said publication is made the *official organ* of, and will fully represent, the Southern Ice Exchange in all matters relating to the trade.

The attention of members of the Exchange and the trade is respectfully called to this matter, and it is earnestly hoped by your committee, that all will encourage the above enterprise by their subscriptions to the publication, and will otherwise extend their hearty co-operation in maintaining a trade paper that will fully and creditably represent our trade.

Chas. W. Biese Chairman

[Sec'y, Treas. and Gen'l Mngr., Lookout Ice and Cold Storage Co., Chattanooga, Tenn.]

Morris Bruyonn

[Pres't Atlanta Ice Co., and Gen'l Mngr. Standard Ice Co., Atlanta, Ga.]

Approved

W. J. Rushton President.

[Gen'l Mngr., Birmingham Ice Factory Co., Birmingham, Ala.]

* * *

The Texas Ice Manufacturers' Association has designated ICE AND REFRIGERATION as the official organ of that association. In making this announcement Mr. F. M. Polhamius, of the Texarkana Ice Co., secretary and treasurer of the association, offers some suggestions to his colleagues in the ice trade, as follows:

"Among progressive ice manufacturers there are none but will quickly appreciate the long felt want of an honest and thorough representation of their business through the medium of a well prepared periodical, devoted purely to their interests, and intended to further those interests by bringing us nearer together, and placing the traffic before the public in the light its merits really deserve. To the disinterested observer the 'machine ice' industry has been an unknown mystery; in fact, it is true that even now, to a great extent, those well informed in the details of ice manufacture are an exception.

"The never-to-be-forgotten season of 1890 drew public attention to the enormous volume of ice manufacture to such a degree that the existence of hundreds of machines, millions of money invested, and a growing occupation, employing an army of the most skilled engineers and mechanics, was discovered, written up and commented upon throughout the country, until the eyes of the public were directed to a heretofore unknown line of trade. How long such a condition of obscurity would have continued under ordinary conditions it is difficult to answer. Yet why should an extensive enterprise remain hidden under selfish and careless oblivion, apparently satisfied within the narrow bounds of a few square miles of individual surrounding territory?

"The rapid strides made in recent years, the great growth and increase of the business, have so entirely absorbed the spare time of those employed that the necessity of fraternal organization was lost sight of through lack of opportunity. The importance of reaching each other through trade journals, exchanges and other mediums, is, however, becoming more and more apparent. Associations for the benefit derived by mutual interchange of experiences are being brought into existence and placed on firm foundations, and each year finds the average 'ice man' more kindly disposed toward his neighbor, more inclined to impart experiences, and making strong efforts to familiarize himself with the latest methods and the newest ideas. Each fresh plant erected exhibits new features and modern improvements,

a better article is constantly being turned out, while the old and unjust prejudice against 'manufactured ice' has almost entirely disappeared.

"The future is certainly promising. All that money and genius can do have successfully brought the formerly scouted theoretical principle to the present gigantic commercial fact. What now remains is to increase our fraternal relations, come nearer together and act in concert as other interests do, to represent ourselves through a competent publication, until the extent of ice making and refrigeration are thoroughly known and properly appreciated. Let no opportunity pass to aid in effecting a primary center of trade, to assist in placing the commodity on a basis of commercial relationship with other productions, and help to establish standard methods of operating the business. Act, and you will be astonished how much will be accomplished."

OUR WELCOME.

The publishers of ICE AND REFRIGERATION beg to acknowledge in this way their indebtedness to the ice trade of the United States for the most cordial reception extended the published prospectus of the new journal. Being convinced of an actual demand for such a journal as is herewith presented to the trade, they had expected, of course, at least a tentative welcome by the trade. In truth, however, the reception given our published prospectus has been more than cordial—it has been royal; and that uncomfortable feeling of solicitude as to the ultimate result of the venture of another trade journal has been entirely brushed aside by the hearty encouragement received on every hand. This sincerity of welcome comes not alone from the advertiser, who is to such a venture what the sun is to life, but from the individuals also who have made the ice trade the great industry it now is, and who are to be the readers of ICE AND REFRIGERATION.

That we may not appear to be in a boasting mood, nor to be "counting unhatched chickens," we take the liberty of quoting from a few of the many letters recently received, at the same time asking the writers to accept this acknowledgment of our appreciation of their favors:

From the ROANOKE ICE CO., Roanoke, Va.

We realize the need of such a journal as you propose to publish, and trust the results will meet your fullest expectations. Herewith find subscription order.

From the ALABAMA ICE CO., Anniston, Ala.

[Having volunteered certain items of valuable information, they say]: Best wishes for big success.

From BORDER CITY ICE & COAL CO., Fort Smith, Ark.

We most cheerfully send our subscription to your new publication, ICE AND REFRIGERATION, and must express our extreme gratification that, at last, a most important industry, and one that is destined to assume mammoth proportions, is to be represented by a periodical that, as its name indicates, will be devoted strictly to the ice and cold storage interests. You certainly have a field in which you should meet with the most *enthusiastic support*; and we believe every manufacturer will not only give you all the information you ask for, but subscribe cheerfully for your publication. Wishing you every success in your new venture, we are, etc.

From PURE ICE & COLD STORAGE CO., Springfield, Ill.

Here you are! We need you in our business. Come and see us when you are out.

From THE HUNTER FRUIT, GROCERY & COLD STORAGE CO., Penn Yan, N.Y.

I hail with delight your esteemed favor, and herewith return our subscription for one year for your paper. It is just what is needed, and I hope you will be successful in securing a large number of subscribers.

From J. C. ATWOOD, Ass't Manager NATIONAL AMMONIA CO., St. Louis.

I am much interested in the success of your new journal. The time for starting such a periodical is opportune; and with the ability, experience and energy you will put behind it, together with the necessary capital, I am quite sure it will succeed beyond your expectations.

From TEXARKANA ICE CO., Texarkana, Tex.

We hail the advent of your publication, and trust you will meet with every success. If I can be of any service to you, call on me.

NO NATURAL CONFLICT.

There is no natural conflict between manufactured ice, from the brine tank, and natural ice, from the great ice factory of nature. In either case, it is the product of low temperatures acting upon water. In either case, it is frozen water-ice, and its properties, qualities and conditions the same. The only difference between the two products is the mode of production; in the one case, by the natural forces of nature, applied by nature herself; in the other, by that same force in nature, applied mechanically by man, who, having in other ways enslaved natural forces and made them subject to his will, now directs another to make it do his bidding.

This mechanical production of ice and cold is the direct result of a demand for cooling agents which may be applied at will in places where nature refuses to produce cold, or under conditions where it is inexpedient or impossible to rely upon her action, which is variable, uncertain, or even unnatural, as in certain localities. It is simply a mechanical, and, for that reason, definite, application of nature's laws to conditions requiring control of the principles of heat and cold in order to obtain certain economic results. It is, therefore, as absurd, as unreasonable and as futile to belittle or affect to despise artificial refrigeration or mechanical ice making, as it would be to condemn any other mechanical force over which man has obtained the mastery and applied to industrial uses. The world did not refuse to utilize steam because it already had used the water wheel, nor the electric motor because it already had used the small sizes of steam engine. It may as well be conceded, once for all, that mechanical refrigeration and freezing are permanently established industries, though of comparatively recent origin, as practical economies, and that their commercial development as industrial factors can end only when the perfect control of heat and cold to fit the purposes of man's wants, comforts or necessities shall no longer be necessary. The mechanical production and distribution of cold is as necessary a commercial principle as the mechanical production and distribution of heat or power.

The efforts, then, of certain dealers in natural ice, and of propounders of systems of refrigeration using natural ice as the cooling agent, to prejudice the public against mechanical refrigeration and the mechanical production of ice, must, of necessity, prove a failure; a failure as complete as the one-time effort to discourage the use of the electric light on account of its alleged and actual dangers. But as the electric light has in no wise decreased the consumption of illuminating gas, and as even the natural gas has been, paradoxical as it may seem, the forerunner of the manufactured fuel gas, so too, the manufactured ice will in very few instances only cause an appreciable decrease in the consumption of the natural product of nature. In certain lines of industry mechanical refrigeration must supplant refrigeration by means of ice; since as for these industries—for example, the packing house and the brewery—so far superior is mechanical to all other modes of refrigeration that no

objections can be urged against it, which will be sufficiently powerful, however unjust or seemingly conclusive, to offset its many obvious and self-evident advantages. In this direction, it may be at once conceded that the reign of natural ice has practically come to an end. Like the old soldier, honored and decorated on many a field of action, whose days of usefulness have been numbered, the ice cutter for the brewery and the packing house has had his record written in honorable terms and been ordered to the rear, his place in the line usurped by a new force, whose career, like that of the young recruit, has but just begun.

But the advent of a new recruit to the vast army of industrial forces need not by any means be a source of alarm to the older members of the rank and file. It may bring emulation; but it ought not to bring conflict within the ranks. In the ice trade there is ample room for both the natural and the manufactured product. While the new process has already conquered certain territory and invaded other, still, in that greatest field of operations, the supply of the demand of the millions, in the thousands of homes and the numberless industrial consumers, which, after all, is the greatest demand of the ice trade everywhere, and ever must be, the place of the natural ice dealer is as firmly fixed as ever; and it will be many years before he will seriously feel the effects of the ice making machine, so slow is man in comparison with the prodigality of nature. In the city of Chicago alone the consumption of ice is from 12,000 to 15,000 tons daily; while the combined production of the commercial ice making plants is only from 400 to 500 tons daily; so that the mechanical product is hardly a drop in the bucket—barely sufficient to meet the natural increase in the demand from month to month.

In the South, where the natural monopoly created by nature herself gives the dealer in manufactured ice an overwhelming advantage, the product of nature at the northern lakes and rivers has largely been, and will in the future still more be, crowded out of that market; and there for the present, at least, will be the great field for the development of the "ice factory" and its increase in usefulness and importance, as well as of shrinkage in the sale of natural ice. It is the only serious loss of territory the natural ice dealer has suffered, but its loss is inevitable and cannot and could not be prevented, no matter how able and concerted the effort to do so. Nature there fights the battles of the maker of ice as against all would-be competitors, just as, in fact, she has always in the past protested against the imported ice of the North by robbing the shipper of a large part of his product in transit. This trade always did have its limitations, in quantity as well as in demand, which latter could come only from the well-to-do, owing to the necessarily high prices imposed. The ice factory has, however, not only usurped the field formerly belonging to the ice shipper of the North, but has, in addition, created a demand entirely its own, just as every abundant supply and cheapness in price of a necessity of life has ever created a demand through its very cheapness and abundance. And as it is undoubtedly true that under ordinary conditions ice can be made mechanically in the South as cheaply or cheaper than the natural ice can be imported, that trade must henceforth remain the sole possession of the southern ice factories, to the exclusion of the ice dealers of the North. This trade, therefore, may be counted on as practically lost to the North, but it is the only trade that has been seriously affected by the advent of the ice machine thus far. There are limitations to the production of ice by machinery in the North, where, under ordinary circumstances, there are no limitations to its production by nature—an advantage which may always remain with the natural ice dealer if he will make the most of it.

ANSWERS TO CORRESPONDENTS.

VACUUM ICE MACHINE—DISTILLING WATER FOR ICE MAKING—EXPANSION OF COMPRESSED AIR—PICTET'S LIQUID.

[This department of ICE AND REFRIGERATION will be conducted for the benefit of the trade generally, as well as individuals, and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

To the Editor: On what principle do the so-called vacuum ice machines work, and are they manufactured in this country? G. B.

Answer.—In the vacuum ice machine, refrigeration is produced by the evaporation of water in a vacuum produced by the joint action of a vacuum pump and an absorbent for moisture. See also article on this subject which will appear in our August issue. At present we do not know of any one manufacturing this machine as a specialty.

To the Editor: Is it absolutely necessary to distill water for ice making; and, if so, what is the object of doing this? H. SCH.

Answer.—The object of distilling water for ice making is two-fold; the first is to drive off the air contained in the water, so as to render the resulting ice clear and free from air bubbles; the second is to destroy any bacteria, or disease germs, that may be in the water. The last object may be attained by simply boiling the water, the former object can only be partially attained in this way.

To the Editor: My partner and myself have been agitated over the question of behavior of compressed air when allowed to expand. My partner says, whenever compressed air expands it will create cold, and I hold that it only does so when it expands against some resistance by moving a piston, or is expanding against the atmospheric pressure; but that no cold will be created when it expands into a vacuum. Whose opinion is the correct one? G. L.

Answer.—Yours is practically correct.

To the Editor: What is the so-called "Pictet's liquid," which is used in Pictet's ice machines, composed of? TH. F. K.

Answer.—We presume you refer to the mixture of sulphurous and carbonic acid, devised by Pictet, and which he is reported to claim to be a regular chemical compound after the formula CSO_4. On the other hand, analyses of the compound made by Bluemke would seem to establish that the compound contains only one molecule of CO_2 for every thirty molecules of sulphurous acid.

THE exports of American beef in May, 1891, amounted to $1,800,000, a falling off of nearly fifty per cent as compared with a year ago. No explanation is offered for the decline except low prices in Europe. It might be possible to find a solution of the problem in a study of the frigorized meat trade of Europe, with the republics of the antipodes, some indications of the growing magnitude of which will be given in the August issue of ICE AND REFRIGERATION.

CURRENT PRICES OF ICE.

Current prices of ice vary so greatly in different parts of the country, that it would be almost impossible to make anything like a concise table that would accurately indicate the rates to consumers in the cities named. The following table and notes appended, however, were compiled from data sent to ICE AND REFRIGERATION, with the request to "notice." Almost every one of these rate cards quotes prices in a different way, and for different quantities; some making rates at from five pounds upward in 10-pound gradations; some from twenty-five pounds up in 25-pound gradations, and so on *ad lib.* The table appended is, therefore, only approximately correct, but nevertheless indicates fairly well the current prices to large and small consumers named. We would be glad to receive further quotations for publication for the benefit of the trade as a whole.

CURRENT PRICES.

Cities.	Large Consumers Per Ton.	Butchers Per 100.	100 to 1,000 pounds. Per 100.	50 to 100 pounds. Per 100.	25 to 50 pounds. Per 100.	Less than 25 pounds. Per 100.
Council Bluffs, Iowa	$3@$4	15@20c	25@30c	40c	50c	60c
Standard Ice Co., Atlanta, Ga	.....	.....	.....	50@70c	.....	80c@$1
Nashville, Tenn	.....	.....	45c	60@70c	80c	80@85c
Memphis, Tenn	$4@$5	45c	50c	$1.00	$1.00	$1.00
Columbus, Ga	.....	20c	40c	.....	50c	50c
Portland, Ore	$8@$10	.....	50@60c	40@60c	75c	$1.00
Birmingham, Ala	$6.00	35c	60c	60@75c	70@80c	80@90c
Pittsburgh, Pa	$4.00	.....	25@30c	35c	.....	.....
Chicago, Ill	.....	.....	25@40c	45c	55c	70c

At Chattanooga, Tenn., prices are quoted for "factory" and "wagon" delivery, for shipping and packed in sacks. These are as follows, prices being for one delivery, per 100 pounds: Factory—200 to 500 lbs., 40c.; 500 lbs. and upward, 30c. Wagon delivery—500 lbs. and upward, 40c.; 100 to 500, 50c.; 25 to 100, 75c.; 25 lbs. or less, ticket rates—22 tickets, 5 lbs. each, $1.00. Shipping prices, F. O. B.—Car loads, 30c.; one-half car lots, 35c.; ton lots, 40c. In sacks, ton lots, 45c. per 100; less than ton, 60c. per 100. Prices guaranteed by Central Ice Co. to parties making contracts.

At Rockford, Ill., prices are quoted for the season at the following rates per month, daily deliveries of quantities named: Ten lbs., $1.50; 15 lbs., $1.75; 20 lbs., $2; 25 lbs., $2.25; washing and putting in box, 25c. per month extra. Lots of 50 to 200 lbs., one delivery, 35c. per 100 lbs.; extra ice, 40c. per 100 lbs.; no piece of ice sold for less than 10c.—*City Ice Co.*

At Pawtucket, R. I., per week: Two hundred lbs., 30c. per 100; 300 lbs., 27c.; 500 lbs., 25c.; water coolers, 5c. per day.—*Seekonk Ice Co.*

PRICES PER HUNDREDWEIGHT.

Gainesville, Tex.—75c., large quantities; $1 to $1.25, in small quantities.

Fort Worth, Tex.—40c., large quantities; 60c. to 75c., small lots.

San Antonio, Tex.—From 40c. to 50c.

Decatur, Tex.—From $1 to $1.50.

San Francisco—$8 to $20 per ton, according to quantity.

Topeka, Kas.—$1.50 per cwt.

Leavenworth, Kan.—80c. per cwt.

New York City.—35c. to 50c. per cwt.

MISCELLANEOUS.

The ice factories of Nashville, Tenn., have reduced last year's prices.

The companies of Newark, N. J., furnish the fire department stations of the city fifteen pounds of ice daily, by contract, at 40c. per week each.

The Knickerbocker Ice Co. of Savannah, Ga., is supplying manufactured ice at 50c. per 100 lbs. This is a reduction of 40 per cent, beginning June 1.

Prices for ice at Toledo are lower this season than for many years, rival dealers having forced a reduction.

At Hoosick Falls, N. Y., the family rate this year is 25c. per 100 lbs.; last year it was 75c.

In Philadelphia, the price is about one-third of last year's prices.

The Cochran-Oler Ice Co., of Baltimore, supplies the postoffice with all ice required this season (about 100 tons) at 15c. per cwt.

DENVER, COLO.

Some special interest attaches to the Denver, Colo., price list, in view of the fact that the sixteen firms in business there last year are this year consolidated, under the control of the Colorado Ice and Cold Storage Co. Although the consolidated ice company's price list, as will be seen, is lower than last year's prices, the newspapers of Denver have bristled of late with attacks on the company by certain parties, who threaten even the establishment of a new company to compete. The price list is as follows:

Quantity.	In Advance.	Time Payments.	Last Year's Prices.
10 lbs. daily, per month	$2.00	$3.00	$3.75
15 " " "	2.25	3.75	4.25
20 " " "	3.00	4.25	4.75
25 " " "	3.75	4.50	5.00
30 " " "	4.50	6.00	65c. per cwt.
35 " " "	5.25	6.75	
40 " " "	6.00	7.50	
45 " " "	6.75	8.25	

Prices for the general trade are as follows:

20 lbs.	15 cents
25 "	20 "
30 "	25 "
40 "	30 "
50 to 75 lbs.	45c. per 100
100 to 300 "	40c. "
325 to 500 "	35c. "
600 to 1,000 "	30c. "

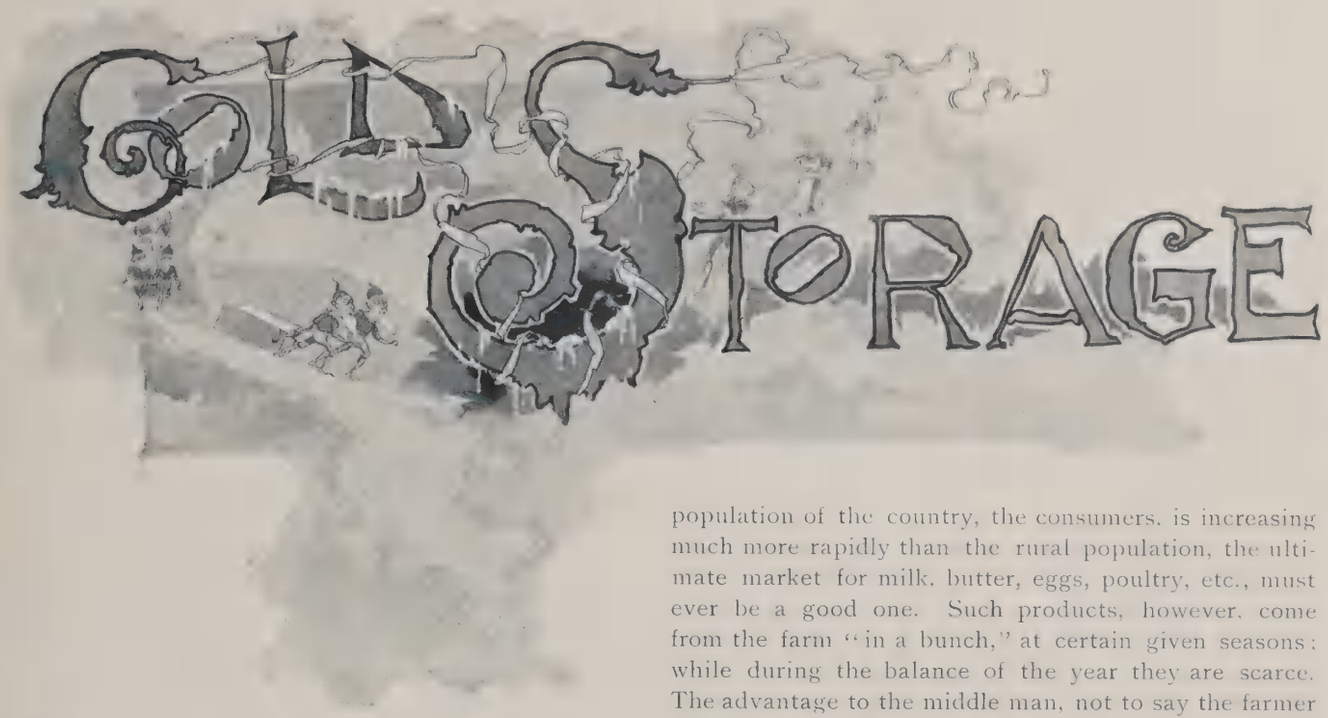
	Manufactured Ice, per ton.	Lake Ice, per ton.
1,200 lbs. to 2 tons, one delivery	$5.50	$4.50
3 to 5 tons, "	5.00	4.00
6 tons and upward "	4.75	4.00

These prices are lower than prices in St. Louis, Kansas City, San Francisco or Texas. Maj. Sowers, the manager, claims that artesian (or manufactured) ice is purer and better, and therefore commands a higher price. The 140 tons made daily by the company is the only ice handled by the delivery wagons for family consumption.

THE Brunswick (Ga.) Ice Co. has declared war against the Macon, Ga., ice companies, and will enter Macon soon with ice $4 a ton cheaper than they claim Macon is now paying. This cut is the result of a Macon concern giving free ice with all the beer sold to Brunswick saloons. —*Many Southern Papers.*

This is "nuts" for the consumer, of course, but one wonders just how long it will be before the ice companies of Brunswick and Macon will enter a complaint that "cut prices" are ruining their business. It is easy to make low prices, but it takes nerve to put them up again, with "all creation" howling about the raise.

THOUSANDS of tons of ice harvested during the winter of 1889–90 from Lake Champlain, at Plattsburgh, were recently dumped into the lake to enable the owners to use the buildings for old lumber! And still we hear that same old howl about the "ice monopolist."



INVEST IN A COLD STORAGE PLANT.

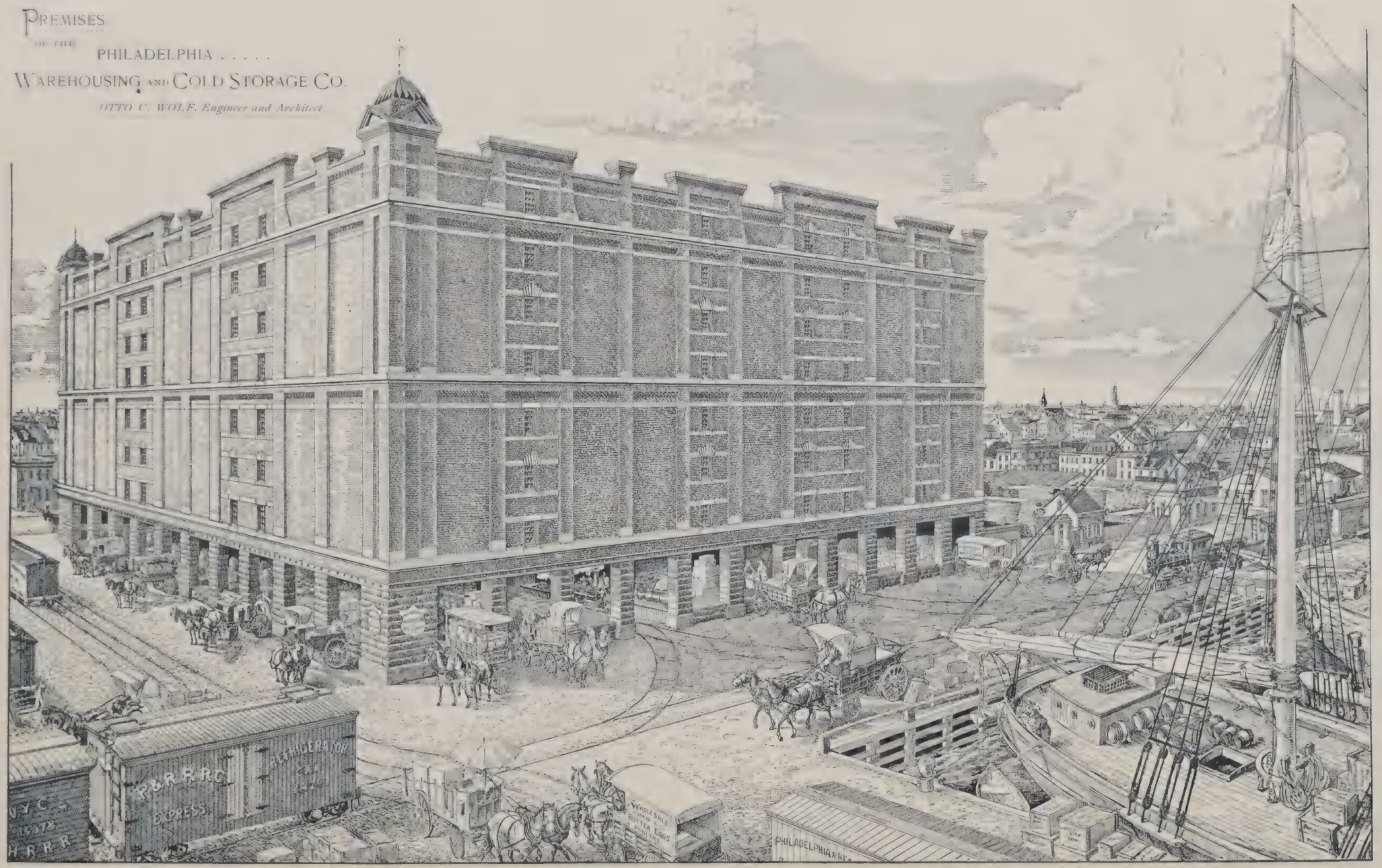
A New York provision paper, in its systematic crusade against the natural ice dealers, urges the erection of ice making plants on the co-operative plan—in which idea our astute contemporary sees a "great scheme" for the co-operative coining of money. It is true that New York has in successful operation at this time an ice factory conducted on that plan; but it is by no means certain that an indefinite extension of the co-operative system would be equally successful among provision dealers. Natural ice is not unduly expensive in any of the great markets of the country, in spite of the clamor to the contrary; and it is not impossible that an indiscriminate rushing into co-operative ventures of this kind would be likely to end in disaster. The old injunction, "Make haste slowly," is a fair suggestion to make under the circumstances.

There is, however, a more legitimate suggestion that might be offered to would-be investors; and that is the existing chances offered by the cold storage business—not necessarily in the great cities, where the demand for cold storage accommodations is being freely met by investors, but in the lesser cities of the country. It will be admitted, we think, that this line of investment has not yet been worked to the extent its importance would warrant. A glance over the country by ICE AND REFRIGERATION reveals the fact that there are comparatively few such storage houses, while a large portion of such as do exist are strictly private concerns, owned and operated by individuals for their own cold storage only. It seems to us that in many of the minor cities of the country, especially those surrounded by the rich agricultural sections contiguous to the great markets, there is room for such establishments for commercial storage by produce buyers, butchers, poulterers, milk dealers, creameries, etc. It would perhaps be found that an "educational campaign" might be a necessary preliminary to their establishment; but when the advantages of cold storage are once demonstrated, there appears to be no substantial reason for not believing they could be made a profitable venture. Even under present conditions, the volume of farm produce is rapidly increasing; and as the urban population of the country, the consumers, is increasing much more rapidly than the rural population, the ultimate market for milk, butter, eggs, poultry, etc., must ever be a good one. Such products, however, come from the farm "in a bunch," at certain given seasons; while during the balance of the year they are scarce. The advantage to the middle man, not to say the farmer himself, of having at hand a reliable place of storage for those products, where they may be safely carried until a more profitable market is offered, certainly can readily be brought to the consideration of those most immediately concerned. The idea, however, is more or less new, certainly in the rural market towns, where the produce comes from first hands and where vast quantities are handled at an ultimate loss for lack of just such facilities for preserving it, even during the short time that much of it is held before it is rushed to the market.

REGULATING THE TEMPERATURE OF ROOMS.

M. K. Bowen, superintendent of the Kansas City Cable Railway Co., has made a new application of an old principle which promises to be of the greatest importance in the regulation of temperature in buildings and cars. By it he expects to utilize the steam and water heating apparatus in buildings and cars to lower the temperature in summer. Briefly explained, the idea is to force compressed air (condensed by means of air pumps) through cold water, the natural expansive force of the then liberated air carrying the cold current through the pipes and into the rooms and cars through perforations in the pipes, these perforations to be made with threads so that caps can be screwed on when steam is used. The constant current of cold air soon reduces the temperature of a room or car, and drives the foul and hot air out through the ventilators at the top. The inventor claims that the temperature can be regulated to a nicety to suit the taste. In cars he expects to be able to run the air pumps with power from the locomotive, and in office buildings, hotels, etc., with the power that runs the elevators. An experiment was made at Pullman the other day, a Pullman sleeper being used for the purpose. The experiment is said to have been immensely successful, and the Chicago, Burlington & Quincy management at once ordered a train fitted up with the device to give it a trial on a greater scale. If it should work, summer traveling will be robbed of its terrors, for it will be possible for passengers to be comfortable in a closed car, free from cinders and other annoyances, even though the mercury on the outside should register 100 in the shade.

PREMISES
OF THE
PHILADELPHIA . . . . .
WAREHOUSING AND COLD STORAGE CO.
OTTO C. WOLF, Engineer and Architect



A MODEL COLD STORAGE HOUSE.

THE IMMENSE ENTERPRISE OF THE PHILADELPHIA WAREHOUSING AND COLD STORAGE CO.

Fronting the Delaware river at Noble street, at the very center of the shipping industries in Philadelphia, there has just been completed the huge and towering main building of the Philadelphia Warehousing and Cold Storage Co., an imposing structure of massive design, eight stories in height, having a frontage on both Delaware avenue and Beach street of 125 feet, a depth of 150 feet, and a total height of 120 feet.

On Beach street, opposite the main building, and in harmony with it in general design, is a second structure, in which are located the refrigerating machines, condensers, boilers, pumps, distilling apparatus, and other machinery to complete the refrigerating plant, as well as a duplicate electrical light and power plant for 1,200 incandescent and arc lights. This building is 65×140 feet, and two stories in height, with gabled roof and ventilator tower, having an octagonal chimney stack 175 feet in height.

THE MAIN BUILDING.

The main building is used as a storage house, and six floors, containing 973,000 cubic feet of space, are prepared for the reception and preservation of perishables and other goods best preserved at low temperatures. On the first floor are the offices, railway trackage, receiving platforms, four hydraulic elevators for the reception and delivery of goods, four freezing tanks for the daily production of fifty tons of chemically pure artificial ice; the ice storage house, and inclosed in a brick shaft, the fireproof staircase leading to all the upper floors. Six floors are partitioned off into ten storage rooms each, having central passages, and so designed that each is accessible to the elevators through an outside chamber or air lock. The eighth floor is used for the general storage of goods not requiring refrigeration, but can be readily converted into cold storage rooms, like the floors below.

Seventeen hundred piles driven to an average depth of forty feet, with ten feet wide concrete footings were required in the foundations, and seventy wrought iron columns support the interior construction on the first floor; but above this, the building is built internally of wood in "slow burning construction," the exterior insulations being brick walls with air spaces.

THE REFRIGERATING MACHINERY.

In the machine house alluded to are located two, 125 tons each, refrigerating machines, made by the Consolidated Ice Machine Co., of Chicago. These monster machines have an efficiency equivalent to the cooling work performed by the melting of 250 tons of ice per twenty-four hours. These consist of four powerful vertical ammonia compressors driven by two horizontal Corliss engines, developing 150 horse power, to which steam is supplied by five horizontal return tubular boilers, aggregating 550 horse power, and made by the Kensington Boiler Works, of Philadelphia. The distilling apparatus was made by the De La Vergne Refrigerating Machine Co. A tunnel, twelve feet broad and eight feet high, connects the two buildings, through which all the pipes, electric wires, etc., are run. Two powerful dynamos, run by independent Armington & Sims engines, constitute duplicate electric lighting plants for over 1,200 incandescent and arc lights. The system was erected by the United States Electric Light Co., and over 60,000 feet of wiring was required, making one of the most complete electric lighting plants erected by this company. The freezing tanks of the artificial ice plant occupy a space 116 ×46 feet on the first floor of the main building, and produce fifty tons of ice per day in blocks of 300 pounds each.



ICE MACHINE HOUSE, PHILADELPHIA WAREHOUSING AND COLD STORAGE CO.

This mammoth enterprise was executed after the plans and under the direction of the eminent engineer and architect, Otto C. Wolf, of Philadelphia, a specialist in the construction of all business enterprises in which artificial refrigeration is required.

OFFICERS OF THE COMPANY.

The officers and the directors of the company are as follows: H. G. Michener, president; Wm. F. Drennen, vice-president; W. T. Robinson, superintendent and treasurer; C. F. Graff, assistant superintendent and secretary. Directors — Benj. Githens, Samuel Lee, H. G. Michener, Samuel Jamison, Jacob T. Bennett, Wm. F. Drennen, N. J. Griffin, A. M. Warthman, Wm. N. Moland.

NEW COLD STORAGE PLANTS.

ALABAMA.

Gadsden—In April last M. Robert Lucas, of St. Louis, and Geo. Cornelson, of Orangeburg, S. C., were given a site for a cold storage plant at Gadsden, Ala., by the Land & Improvement Co., and immediately proceeded to improve it. The building erected is 50×100 feet: and the entire plant is now finished. The company will do a general storage business, and will enlarge its facilities as fast as the business demands. A switch connects the plant with all of Gadsden's railways.

Huntsville—J. R. Yeatman has about completed the erection of an ice house and beer storage house for the storage of Chattanooga beer and ice, which are having a large sale in that city.

ARKANSAS.

Little Rock—Negotiations are said to be going on with a view to the erection of a $200,000 ice factory and cold storage plant at this point for Phil Armour.

CALIFORNIA.

San Diego—Otto G. Benschuetz has just completed a large and well equipped cold storage house.

ILLINOIS.

Chicago—The great enterprise known as the Chicago Cold Storage Exchange has been sold to an English syndicate for $4,500,000.

Chicago—Central Market Co. have recently put in a Hendrick (Pontifex) machine, for which first charge of ammonia was supplied by the National Ammonia Co.

Chicago—Contracts have been let by Underwood & Co. for a large cold storage building to be erected back of their packing houses on Lumber street. It will be six stories high, 109×219 ft., and will cost $150,000.

Chicago—The new Central Market, at South Water and State streets, Chicago, was formally opened for business July 1. There are sixty-one stalls, and a cold storage vault lies beneath each stall. The market is 114×166 feet in size; and over the market proper is an extensive cold storage system. The building is fireproof, and lighted by skylights and incandescent electric lamps.

East St. Louis—East St. Louis Ice & Cold Storage Co. was incorporated July 1, at East St. Louis; capital stock, $300,000; for the manufacture of ice and cooling space; incorporators, Alonzo C. Church, Charles H. Sharman, and William S. Hodges.

Peoria—The Jos. Schlitz Brewing Co. have built a cold storage house at this place.

Quincy—A new ice and cold storage plant has been erected at this place by the W. L. Distin Producing Co.

LOUISIANA.

Baton Rouge—A new ice and cold storage establishment, building, 50×200 feet, is being erected, with a 50-ton machine.

MISSOURI.

St. Louis—The St. Louis Automatic Refrigerating Co. will locate its cold storage plant near Union Market.

NEW YORK.

New York—The Gansevoort Freezing & Cold Storage Co., of New York city, have purchased land for the erection of another large cold storage house in that city. The refrigeration will be taken from their present plant to the new building, when completed, by underground pipes.

New York—P. Keller, of the Pontifex company, will put a machine into the cold storage house acquired by them from Hermann & Co., New York.

New York—Wells Bros. will substitute an ice machine for ice for refrigerating their cold storage rooms.

NORTH CAROLINA.

Raleigh—The Plate Ice Co. will, this coming fall and winter, make some considerable alterations at their factory in order to provide cold storage room, for which they find a demand.

OHIO.

Sandusky—A. J. Stoll will build a cold storage establishment shortly.

Steubenville—A cold storage house has been opened, of which ex-Mayor Oscar Brashear is general manager.

TENNESSEE.

Knoxville—J. M. Wilson & Co. talk of building a cold storage house.

TEXAS.

Belton—Baker & Vickery's ice factory have erected two refrigerating rooms, each fifteen feet square, for the storage of meats and beer.

VIRGINIA.

Roanoke—A new cold storage warehouse has just been completed, with an ice factory in connection with it. There are seventeen refrigerating rooms in the warehouse; and orders for ice from the city and surrounding towns give every promise of financial success for the undertaking.

WISCONSIN.

Fond du Lac—The new freight depot for the St. Paul road will have a large cold storage department.

Green Bay—Joannes Bros. recently opened a cold storage house in that city. They use natural ice as the refrigerating material.



PACKING HOUSE NEWS.

——Richard Webber, packer of Harlem, N. Y., will put in an ice machine.

——Kanenbley Bros., of New York city, will put an ice machine in their cold storage cellars.

——A new packing house, with a capacity of 1,000 hogs daily, is to be erected at Dubuque, Iowa.

——The Puyallup (Wash.) Packing Company is increasing its ice capacity and cold storage facilities.

——Messrs. C. H. Widmayer & Sons, Jacksonville, Ill., have put in a Frick machine to cool their meat storage room.

——The Dubuque, Iowa, Butchers' Association slaughter and packing house put up 1,500 tons of ice for this season's cold storage.

——The International Packing Co., composed of English capitalists, have purchased a site in Ashland, Wis., for a large refrigerator warehouse.

——Messrs. Nelson Morris & Co., Chicago, who are continually enlarging their cold storage capacity, have recently added another machine.

——The new large ice machine at Swift & Co's packing house, Kansas City, Mo., has just received its first charge of ammonia from Herf & Frerichs Chemical Co., St. Louis.

——The Fort Dodge, Iowa, packing house filled two large ice houses last winter with which the managers expect to operate the house through the summer, instead of shutting down, as formerly.

——In May last the Iowa City, Iowa, Packing & Provision Co. began the erection of a three-story building, 100×125 feet, for cold storage, with a capacity for 10,000 tierces, to cost from $10,000 to $15,000.

——J. H. Michener & Co., 946-62 N. Front st., Philadelphia, packers of meat, have recently added to their works a refrigerating plant for cooling the basements of their buildings, which are used for storage.

——The Kansas City Packing Co., which failed last November, and which has since been reorganized with a capital stock of $2,000,000, and which is now styled the Phœnix Packing Co., has resumed active operations.

——The El Modelo packing house, A. D. Barling, proprietor, at Fresno, Cal., burned during the winter, will be rebuilt. It will be of *adobe*, one story high, with 6,000 square feet of floor surface, and contain good machinery.

ICY ITEMS.

——Mr. A. J. Barr recently purchased a controlling interest in the Bloomington Ice & Cold Storage Co., Bloomington, Ill.

——The Missouri Car Refrigerating Co.'s buildings, St. Louis, were partially destroyed by fire June 25. Loss about $16,000; insured.

——The Lamar Artificial Ice and Refrigerator Co., Lamar, Mo., have charged their new machine with ammonia from Herf & Frerichs Chemical Co., St. Louis.

——Pursuant to direction of court the assignee of the insolvent Consolidated Ice Machine Co., of Chicago, has offered for sale all the assets of said company.

——Mr. James B. Craft, of New York, has just completed the erection of one of his refrigerating machines in the wholesale establishment of Swift & Co., on Thirty-ninth street, New York.

——The Sheffield Brewing Co., Sheffield, Ala., want a second hand ice and refrigerating machine of twenty-five to thirty tons capacity. Anyone having such a machine for sale should address as above.

——Mr. A. W. Swanitz, expert in ice and refrigerating machinery made tests last month and accepted the following refrigerating and ice plants: St. Joseph, Mo., for Artesian Ice Co., 75-ton Boyle machine; Chicago, for Anglo-American Packing Co., 150-ton Bouton Foundry machine; Chicago, for Underwood & Co., 150 ton Linde (Wolf) machine.

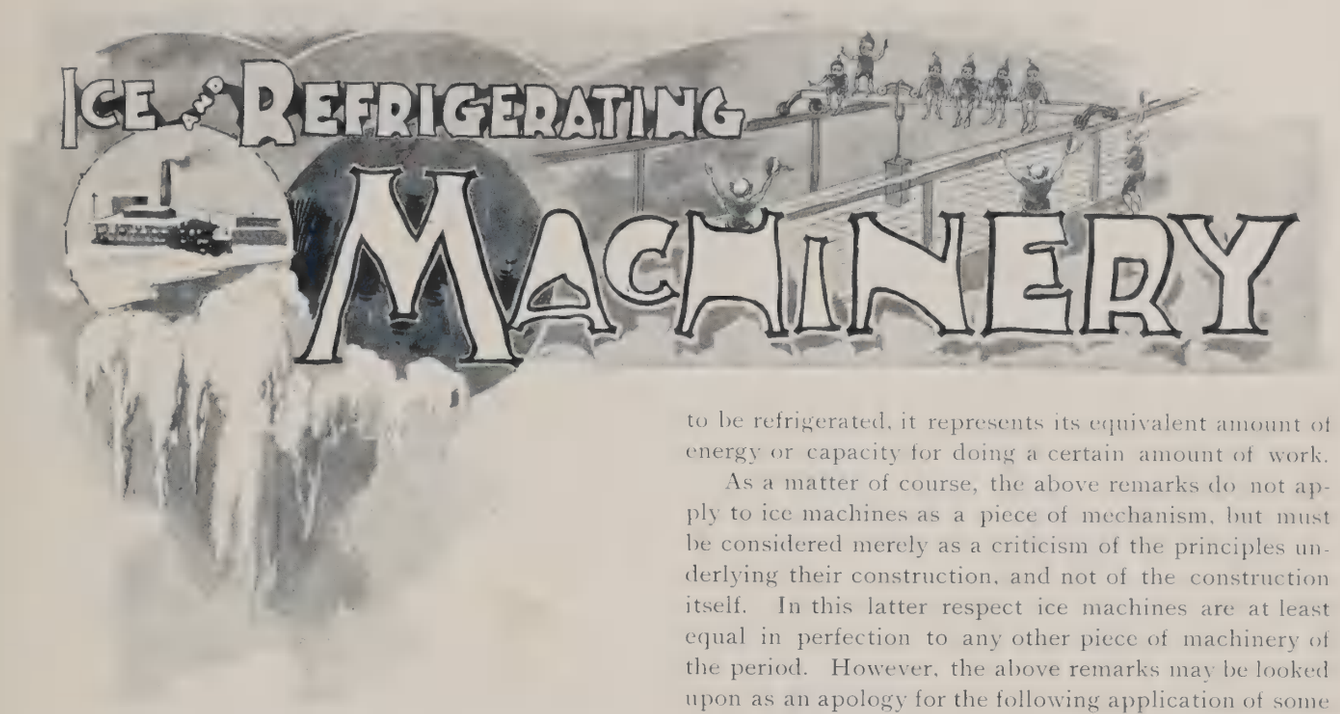
REMOVALS.

——The Messrs. Lovell, of Eustis, Fla., are to remove their ice factory to Tavares to secure better shipping facilities.

——The Bristol, Tenn., ice factory, owned by J. F. Starwinski, has been removed to Morristown, Tenn., whose citizens voted to release all taxes on the factory for five years.

——Mr. Springer, of St. Augustine, Fla., having secured permission to erect a corrugated iron building to be used as an ice factory, has removed his twelve-ton machine to Fernandina.

——The Cornelson ice factory at Orangeburg, S. C., has been closed, Mr. Cornelson having joined Mr. Lucas in a cold storage plant at Gadsden, Ala. Orangeburg will have to rely upon Columbia or Charleston for its ice hereafter.



THE ICE MACHINE OF THE FUTURE.

By J. E. Siebel, Director of the Zymotechnic Institute, Chicago.

Comparatively speaking, ice machines and refrigerating machines in general, have been before the public but a few years, yet so great and obvious are the advantages which they offer that nowadays no establishment connected with the manufacture of articles of food and drink is considered complete without them. They have ceased to be a desirable convenience, but have become a necessity, and their introduction consequently has been a great success. This term, however, can hardly be applied to them if considered in the light of the rational application of the principles of thermodynamics. So far are the ice and refrigerating machines of the present day from being a success in this direction that they may be put down as exemplary instances of a wasteful destruction of energy—indeed, even more so than many other mechanical contrivances. Doubtless such language will appear bold and even worse to many who are primarily impressed with the great utility, adaptability and popularity of the machines in question, yet a closer investigation of the underlying principles will prove the correctness of the above assertion.

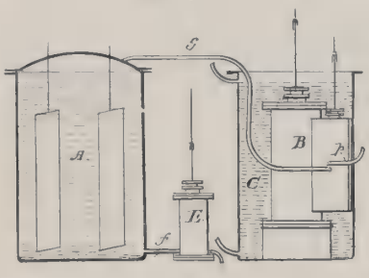
Take, for instance, that class of refrigerating machines in which the refrigeration is produced by the compression and subsequent expansion of a gaseous body, such as ammonia, sulphurous acid, air, etc. In all those machines a large part of the energy used for compression is converted into heat, and this heat, *i. e.*, its equivalent of mechanical energy, is not only uselessly carried away by the condensing water, but in addition to that the providing of the cooling water causes great expense in itself. Again, when the compressed gases are allowed to expand in the rooms to be refrigerated, they do this by absorbing the heat of these rooms, and this heat, *i. e.*, its equivalent of mechanical energy, too, is lost; and besides this it increases the pressure of the refrigerating medium. Thus the process of refrigeration is carried on by a two-fold wasting of energy, while reasonably this process should, on the contrary, produce energy, since whatever amount of heat is withdrawn from the medium to be refrigerated, it represents its equivalent amount of energy or capacity for doing a certain amount of work.

As a matter of course, the above remarks do not apply to ice machines as a piece of mechanism, but must be considered merely as a criticism of the principles underlying their construction, and not of the construction itself. In this latter respect ice machines are at least equal in perfection to any other piece of machinery of the period. However, the above remarks may be looked upon as an apology for the following application of some novel principles which are likely to be considered in the construction of ice machines at a not remote time.

The refrigerating apparatus which is the subject of this sketch is designed with a view to utilize this energy, or, in other words, to produce cold, not by wasting energy, but by producing energy. To attain this object the refrigerating media are compressed gases (hydrogen and oxygen), not compressed by mechanical force, but readily produced in the compressed state by water being decomposed by an electric current in a closed vessel. The gases so compressed do not require any condensing or cooling water to be relieved of the heat, which is always generated by mechanical compression. But in being allowed to expand, while doing work, they create cold just the same as if they had been compressed by mechanical means. Accordingly these gases being under very great pressure, are allowed to propel engines, either singly, as hydrogen and oxygen, or as a mixture of hydrogen and oxygen, in which case only one cylinder is needed. The gases having thus done useful work, and having had their temperature reduced correspondingly, are then used for refrigerating purposes by being carried through the rooms to be refrigerated, or through salt brine, etc. After having done duty in this manner, and being reduced in pressure to that of the atmosphere, the gases (by virtue of the potential energy stored up within them on account of their chemical affinity), are used to do labor in the form of electricity, light or mechanical force, to decompose the water in the first place, or to perform an equivalent duty. However this may be arranged, a casual consideration will show that, theoretically speaking, the energy stored up in the gases hydrogen and oxygen is equivalent to the work required to decompose an equivalent amount of water. It is in fact greater, since an amount of energy corresponding to the heat absorbed by the expanding gases during refrigeration is to be deducted from the work necessary to produce the gases by decomposition of the water. In other words, always speaking theoretically, there are gained in this system of working at least the power produced by the expansion of the gases and the refrigeration produced thereby in the bargain.

In order to more fully understand the theoretical possibilities of such a system the accompanying diagram shows that portion of the same which deals with the conversion of refrigeration into power, leaving out of consideration that portion which deals with the mutual conversion of energies which are admitted to be equivalent. Accordingly the following considerations are confined to the purely theoretical side of the question, leaving out of consideration the loss of power always incident to the conversion of different energies into one another, the difficulty attending the utilization of high pressure in motors, and also other items which bear on the practical execution of the system. Questions of this kind are hardly in proper time, as long as the issues relating to the theoretical possibilities of the system are not fully settled. In this manner misunderstandings which are apt to arise from an undue complication of the system with side issues will be avoided, and the essential points will be brought out more clearly.

In the accompanying diagram, *A* represents a vessel in which water can be decomposed by an electric current under high pressure. *B* an engine or motor which is operated by the mixed gases, hydrogen and oxygen, generated or contained in the vessel *A* under a very great pressure, the gases being carried to the engine by means of the pipe *g*. *C* is a vessel surrounding the engine or motor *B*, through which passes matter to be refrigerated, say salt brine or any other liquid. *E* is a small force pump to replace by means of pipe *f* the water which has been decomposed in the tank *A*; *p* is the pipe through which the mixed gases hydrogen and oxygen leave the motor, having been reduced therein to the pressure of the atmosphere.



Before going further, especial attention should be directed to the fact that the generation of pressure of the mixed gases in *A* does not require any energy over and above the amount of energy needed to decompose the water under pressure, which amount is the same as if the decomposition took place in vacuum or under atmospheric pressure, barring polarization or other secondary actions. This fact, while in accordance with the theory, is also established by the experiments of Gassiot and confirmed by researches of others. Special stress is laid on this fact, because it appears not to be universally understood that way, and because it forms an essential feature in the discussion of this subject.

For this purpose we will assume that 3.5 kilograms of water are decomposed in the vessel *A* per hour under a pressure of 256 atmospheres, and that the mixed gases so produced pass through the motor *B*, where, while expanding, they do a certain amount of work and absorb a certain amount of heat from the medium surrounding *B* and contained in the tank *C*, which latter medium suffers a corresponding amount of refrigeration. This refrigeration on the heat so absorbed is actually the source of the work done by the motor *B*. The mixed gases are supposed to leave the motor *B* by the exit pipe *p* at the ordinary pressure, and with unchanged temperature.

Under these circumstances the mixed gases leaving the motor possess, by reason of their chemical affinity, an energy theoretically just equal to do the work required to produce an equivalent amount of mixed gases under pressure in *A*. As to whether and how this could be practically effected is not material for our present purpose, but being a correct proposition theoretically, it follows that the work done in the motor *B* by the expansion of said gases, as well as the refrigeration incident to such expansion while doing work, are a clear gain, theoretically speaking, and the only question is in regard to the amount of such gain. 3.50 kilograms of water, if decomposed under ordinary pressure, yield about 6,400 liters of mixed gases (hydrogen and oxygen), and if we assume that they follow Mariotte's law up to such pressure, they will at the pressure of 256 atmospheres occupy a space of $\frac{6400}{256}$, or 25 liters. The work capable of being done by 25 liters under a pressure of 256 atmospheres, while expanding to 6,400 liters under constant temperature, is equal to about 400,000 kilogrammeters, which are equal to

$$\frac{400,000}{270,000} = 1.48 \text{ horse power.}$$

The amount of heat absorbed by the gases while thus expanding against resistance must be equivalent to the work done, and is therefore equal to

$$\frac{400,000}{423} = 945 \text{ kilogram—centigrade units (metric calories).}$$

These figures represent the theoretical amount of work and refrigeration obtainable by this arrangement in an hour, from which, however, must still be deducted the work done by the pump *E* in introducing 3.5 kilograms water against a pressure of 256 atmospheres, in order to replace the water which has been decomposed. The work required to do this amounts to

$$\frac{340 \times 10 \times 258 \times 1.033}{100 \times 270,000} = 0.035 \text{ horse power,}$$

or the net theoretical work gainable is equal to 1.48 − 0.035 = 1.445 horse power, besides a refrigeration amounting to about 945 metrical units of heat.

Since the heat produced by the production of 9 kilograms of water is equal to 35,000 large calories, the amount of work required to decompose 3.5 kilograms water is equal to

$$\frac{35,000 \times 3.5}{9} = 12,800 \text{ large metric calories,}$$

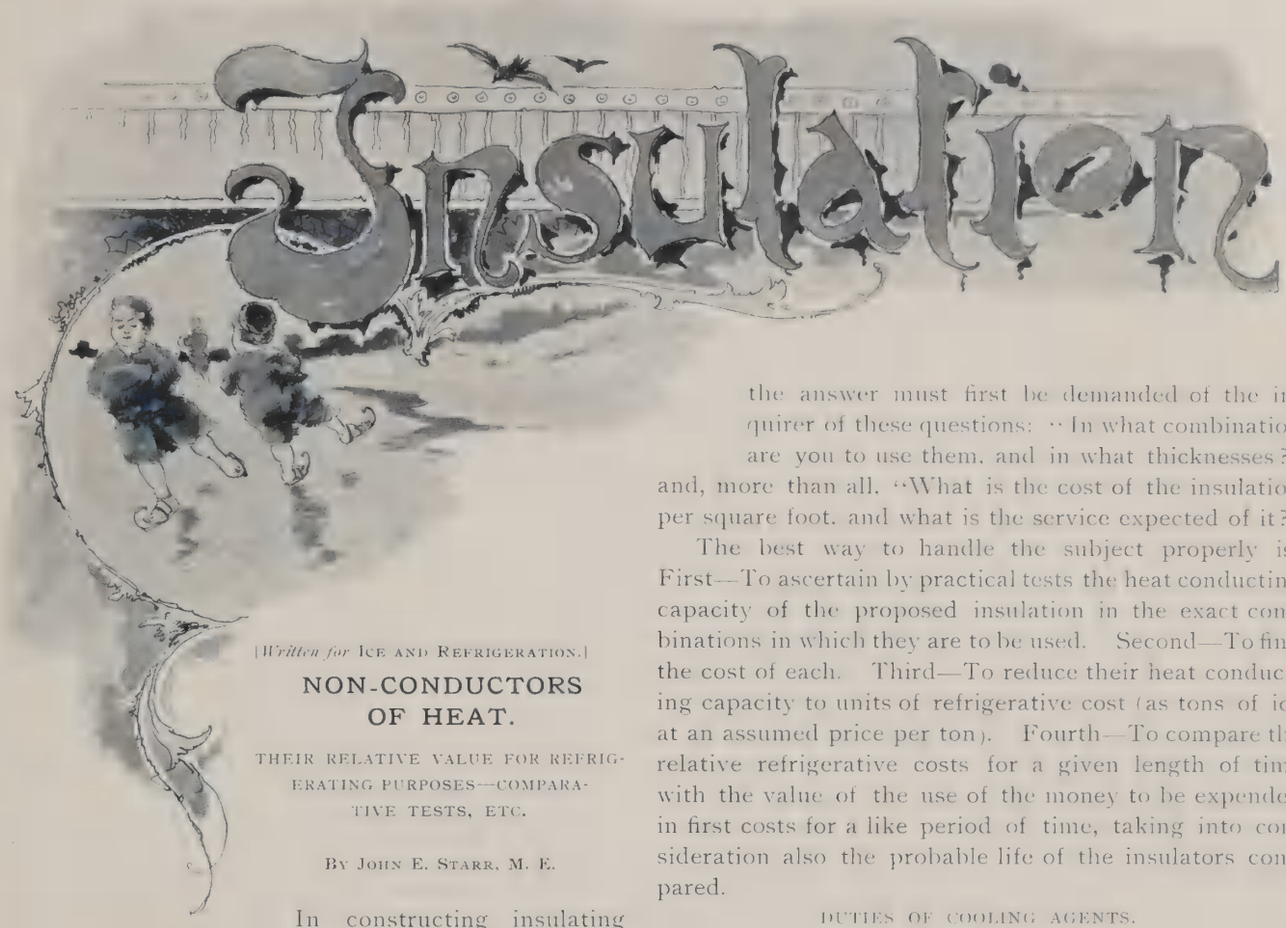
or equal to 12,800 × 4,155 = 53,184,000 volt amperes, and their equivalent in mechanical work per hour is equal to

$$\frac{53,184,000}{2,650,000} = 20.1 \text{ horse power.}$$

This means that by using over and over again 20.1 horse power, a gain of 1.4 horse power and 940 calories, theoretically speaking, can be produced by this system—a gain which, if not very significant within itself, may be secured in special cases.

While this system contemplates the creation of power from apparently inexhaustible supplies (sources of heat above that of gas expanding at low temperatures), it, nevertheless, must not be confounded with attempts at perpetual motion (*perpetuum mobile*), for it creates no power within itself, but simply converts into power heat which it derives from without, from sources which are by no means always flowing or accessible.

——The new ice factory at Suffolk, Va., just beginning the making of ice, had on exhibition a large slab of ice before the bazaar, with a pineapple, orange and banana frozen in it. This unique sight caught the eye of all passers-by.



[*Written for* ICE AND REFRIGERATION.]

NON-CONDUCTORS OF HEAT.

THEIR RELATIVE VALUE FOR REFRIGERATING PURPOSES—COMPARATIVE TESTS, ETC.

By JOHN E. STARR, M. E.

In constructing insulating walls and partitions for refrigerators and cold storage and freezing rooms, there seems to be a very wide difference of practice. This difference results largely from the absence of proper calculation, from an accurate basis, as to the true insulating values of various styles of construction. Laboratory test figures as to the relative heat-conducting capacities of the many insulating materials in the market are published by those interested in their sale, and are often twisted and distorted in a manner entirely misleading to the buyer, who is overwhelmed in turn by each rival salesman with a mass of scientific tests showing conclusively that each one's particular insulating material is the best. Oftentimes the results of scientific tests, as to conductivity, are honestly used, but even then they are in a certain way misleading to the layman.

The bulk of the carefully conducted tests of the transmission of heat of materials suitable for refrigerating insulation have been made on a comparison based on equal thicknesses of the materials tested, and, of course, are of the utmost value as far as they go; but it must be remembered that all, or nearly all, heat protective walls and partitions are built necessarily of a combination of insulating materials, as a combination of wood, air space and paper, or wood with some filling (as slag wool, charcoal or sawdust), with paper and air spaces, or a combination of tiling with air space insulation, or with some suitable filling, etc., etc. Varying thicknesses of the different varieties of insulating materials are also used, and at varying costs. So when such general questions are asked as, "Is air space better than mineral wool?" or, "Is charcoal as good as hair felt?" and, "Will lamp black beat sawdust?" and so on through the list, the answer must first be demanded of the inquirer of these questions: "In what combination are you to use them, and in what thicknesses?" and, more than all, "What is the cost of the insulation per square foot, and what is the service expected of it?"

The best way to handle the subject properly is: First—To ascertain by practical tests the heat conducting capacity of the proposed insulation in the exact combinations in which they are to be used. Second—To find the cost of each. Third—To reduce their heat conducting capacity to units of refrigerative cost (as tons of ice at an assumed price per ton). Fourth—To compare the relative refrigerative costs for a given length of time with the value of the use of the money to be expended in first costs for a like period of time, taking into consideration also the probable life of the insulators compared.

DUTIES OF COOLING AGENTS.

The cooling agent used in a refrigerator, whether it be ice or some form of mechanical refrigeration, has a three-fold duty to perform after the box has once been cooled to its required temperature.

First—To cool the material placed in the box to the required box temperature.

Second—To cool the air admitted by the opening and closing of the doors or other apertures in the box.

Third—To take up the heat that finds its way through the insulation.

It is obvious that the first two duties mentioned are not dependent on or relative to the third; that is to say, whether the insulation is good or bad, a certain amount of heat will have to be taken up by the refrigerative agent from the material placed in the box to cool it to the box temperature, and a certain amount of heat will also have to be taken from the warm air entering through the open doors or other apertures, and that these amounts have nothing to do with the insulation. The third duty of the refrigerative agent, above mentioned, is generally its greatest; that is, *the largest proportion of the refrigerative agent is used to absorb the heat that comes through the insulation.*

It is plain, then, that the bulk of the work of the refrigerative agent is not, as is often supposed, in proportion to the cubical contents of the box, *but in proportion to the square surface exposed.* The square feet of surface exposed grow rapidly less in proportion to the cubical feet contained, as the cubical contents increase. Hence, while the cost of taking care of conducted heat per cubical foot diminishes as the size of the box increases, it remains the same per square foot. As the cost of the insulation is, of course, in proportion to the square surface, we have a common basis to figure on, when we

are attempting to discover the relation of the first costs to the duty costs.

THE UNIT OF CONDUCTIVE VALUE.

It is hardly necessary to state that the rate of the flow of heat through the refrigerating wall, or partition, is in proportion to the difference of temperatures existing on each side of the wall, and that the greater the difference the greater will be the amount of heat transferred through insulators of the same value. The unit, then, of conductive value is the amount of heat that passes through a unit of surface in a unit of time at a unit of difference in temperatures; or, to express it in the terms hereafter used, the value of the insulating wall, or partition, should be based on the number of British thermal units passing per day per square foot of surface per degree Fahrenheit of difference of temperature on each side of the insulation. The British thermal unit (or B. T. U.) is the amount of heat required to raise one pound of water one degree of Fahrenheit. One pound of ice in melting will absorb 142 B. T. U., or as much heat as would lower the temperature of 142 pounds of water one degree.

HOW TO TEST INSULATING WALLS.

In testing the value, therefore, of insulating walls or partitions, it is necessary to devise some means of determining accurately the rate of the flow of the heat through the wall or partition to be tested. This can be done with considerable accuracy in several different ways. One of the most convenient methods is to receive the heat which is conducted through the insulation into a body of water of known weight. The amount of heat conducted in a given space of time is then readily calculable by multiplying the weight of the water by the number of degrees of temperature through which it was raised by the heat so received by it.

The writer, in investigating the values of insulating construction, has used a rather simple but very effective apparatus for accurately measuring the flow of heat. He had a box carefully constructed and thoroughly insulated on the top, bottom and two sides. The two ends remaining (exposing an area of something over four square feet) were used as the test ends, and the various styles of construction to be tested were built in these ends. In this way two tests could be made at the same time. Directly against these two ends were placed water reservoirs of thin galvanized iron of the same superficial area as the test ends, that is to say, something over four square feet. These reservoirs were about one inch wide and each held from twenty-five to twenty-seven pounds of water. Outside of these reservoirs was another very thick insulation against the outer air, all except a small opening in the middle of the top for thermometer readings. A steam coil was placed inside of the box, and connected at its inlet with a steam boiler and at its outlet with a steam trap. By regulating the steam pressure the interior of the box can be kept at any desired temperature; and the construction is such that any heat that finds its way into the water must come through the insulation to be tested, and that all the heat that comes through the insulation must find its way into the water, as the water exactly covers the insulation. The tests, therefore, can be made quantitative, as well as qualitative, by observing the rise of temperature of the water, and taking into account its weight. Readings are taken at regular periods of the temperature inside the box, and of the water in each cap, or reservoir, and of the surrounding atmosphere. The water caps, however, are so thoroughly insulated from the surrounding atmosphere that unless the temperature of the water in the caps rises to a very high degree, and unless the test is of very long duration only a small amount of heat escapes from the water and passes into the air. The value of the insulation surrounding the caps being known, however, a correction can be made, if necessary, for such escape of heat from the water.

DETAILS OF TESTS.

As illustrative of the method of making the calculations above referred to, the detail of a couple of tests with this apparatus may be described, and the net results of others given. The object of the first test was to discover the relative value of two kinds of construction of fireproof insulation, in which hollow tiling takes the place of wood, and in which the insulating properties of the construction depend on the non-conducting value of the material of which the tiling is made and also on the air spaces inclosed in the tiling. It was desirable to discover how much a "filling" between the tiling would add to the insulating value. The most available non-combustible filling materials seemed to be either mineral wool or asbestos. The former was chosen for the trial. The character of the two kinds of construction selected to be compared, therefore, was a wall made of three hollow tiles as against a wall made of two hollow tiles with the space between, equal in width to one tile, filled with mineral wool.

The two styles of construction were placed in either end of the test box, and the conditions as to heat and outside temperature being, of course, the same, the mere observation of the rise of temperature in the water caps would give an indication of the relative value of the insulation, while the calculation of the amount of heat absorbed by the water would, of course, give the quantitative value. The record of this test is as follows:

Duration of test, thirty two hours.

Mean temperature inside box		260 deg. F.
Pounds of water in each cap		27
Temperature of water in each cap, beginning of test.		66 deg. F.
" at end of test, three-tile end		131 "
" " " two-tile and mineral wool end		95 "
Total rise in temperature:		
Three-tile end		65 "
Two-tile and mineral wool end		29 "
British thermal units passed through (27 lbs. of water × 65.)	Three-tile end	1,755.00
British thermal units passed through (27 × 29.)	Two-tile and mineral wool end	783.00
Surface exposed each end, four square feet:		
British thermal units per square foot per day (24 hours)	Three-tile end	329.06
British thermal units per square foot per day (24 hours)	Two-tile and mineral wool end	146.81
Excess of heat units per square foot per day passed by three-tile end over two-tile and mineral wool end (represents saving per square foot per day at test difference of mean temperatures)		182.25
Mean temperature water cap, three-tile end		100.3
" " " two-tile and mineral wool end		81.4
Mean difference, three-tile end		159.7
" " two-tile and mineral wool end		178.6

British thermal units per square foot per day, per degree of mean difference inside and outside temp ..... } Three-tile end.... 2.06

British thermal units per square foot per day, per degree of mean difference inside and outside temp..... } Two-tile and mineral wool end.... .82

The amount of heat conducted by the three-tile construction as against the amount conducted by the two-tile and mineral wool construction was, therefore, as 2.06 is to .82 ; or, in other words, the three-tile end conducted two and one-half times as much heat as the other end. So much for proportional values.

RELATIVE CASH VALUES.

In order to discover the relative cash duty values of the two styles of construction, we must reduce these data to terms of known refrigerating costs. We will assume, therefore, that walls are to be built of either of these two styles of construction for duty in a cold storage warehouse, where the average outside temperature is 76 deg. F., and the average inside temperature to be maintained is 36 deg. F., or a difference of 40 deg. It will be seen by the above test that the amount of heat conducted per degree of difference in inside and outside temperatures was, for the one style, 2.06 B. T. U., and, for the other style, .82 B. T. U. This was, however, at a difference of temperature of over 150. It is a well known fact that the amount of heat transferred per degree of difference increases somewhat with each degree of increase of difference of temperatures. The increment of the amount of heat conducted as the difference in temperature increases is fairly well established, and a calculation based on what the writer believes to be the proper data would give for the number of B. T. U. passed per square foot per day per degree of difference between differences of from 30 deg. to 50 deg., a value of 1.9 for the one style, and .802 for the other style, if their differences at between 150 and 180 (such as existed in the test above), were 2.06 and .82 respectively.

We have, then, for an inside temperature of 36 deg. and an outside temperature of 76 deg., a rate of conduction per square foot per day of (40×1.9) 76 B. T. U. for the three-tile construction; and (40×.802) 32.1 B. T. U. for the two-tile and mineral wool construction, a saving, under these conditions, per square foot per day, in favor of the two-tile and mineral wool construction, of 43.9 B. T. U. The saving in ice per square foot per day would, therefore, be $\frac{43.9}{142}$ or .309 pounds; or, the saving in ice for 1,000 square feet per day would be 309 pounds, or, on 6,472 square feet of insulation, the saving would be one ton of ice. The saving in refrigerating power of the one style of construction over the other, in a cold storage warehouse of about 300,000 cubic feet capacity, would figure up somewhere between five and six tons of ice melting capacity daily, taking into consideration only the outside square surface of such a warehouse. The problem is thus reduced to terms where the financier can take hold of it and follow it to a business conclusion.

OTHER TESTS OF MATERIALS.

The results of other tests on various styles of construction now frequently found in use in refrigerators and cold storage rooms, are given below. The materials used are named in the order they occur in the wall, commencing at the outside. The column headed "Rate," gives the B. T. U. per square foot per degree of difference between inside and outside temperature, at differences of from 25 to 50 degrees. The next column gives the number of pounds of ice that would have to be melted per day to maintain an inside temperature of 36 degrees against an outside temperature of 76 degrees for each 100 square feet of surface, leaving the opening of doors and cooling of material out of consideration.

MATERIALS.	Rate B. T. U.	76° F. outside. 36° F. inside. Lbs. Ice per 100 sq. ft.
⅞-inch yellow pine, paper one layer, two inches slag wool, one layer paper, ⅞-inch yellow pine, one-inch plain air space in twelve-inch squares, one layer paper, ⅞-inch yellow pine	1.18	33.2
⅞-inch yellow pine, one layer paper, two inches mineral wool, one layer paper, ⅞-inch yellow pine.....	3.95	111.2
Same with three-inch mineral wool.....	3.02	85
⅞-inch yellow pine, one layer paper, 1¾ inches patent cardboard (two-ply), air space filling (air cells very small, one to two cubic inches), one-inch plain air space twelve-inch squares, one layer paper, ⅞-inch yellow pine.....	1.77	50
⅞-inch yellow pine, one layer paper, 2¼ inches three-ply patent cardboard air space, one-inch plain air space, one layer paper, ⅞-inch yellow pine.....	1.5	42.2
⅞-inch yellow pine, two layers paper, 2¼ inches three-ply patent cardboard air space, one-inch plain air space, two layers paper, ⅞-inch yellow pine, 1¼-inch plain air space, two layers paper, ⅞-inch yellow pine.....	1.17	32.9
One-inch oak, one layer paper, one inch charcoal, ½-inch pine, "family refrigerator"..	5.7	160.7
⅞-inch yellow pine, one layer double heavy cemented paper, one-inch plain air space in twelve-inch squares, one layer double cemented paper, one-inch plain air space in twelve-inch squares, one layer double cemented paper, ⅞-inch yellow pine.....	4.56	128.4
One hollow tile (three-inch), one layer paper, two hollow tiles, three-inch each..	1.9	53.5
One hollow tile (three-inch), rock wool, three inches, one hollow tile, three-inch	.802	22.6

Some of these figures are strictly applicable to vertical walls only, as air space insulation is more effective in a ceiling or floor than in a vertical partition or wall.

ACCIDENTS.

——A fatal accident occurred recently in an ice factory at McKeesport, Pa., which was the more distressing, as the death of Thomas Thompson, the victim, was the result of inexcusable, not to say criminal, carelessness. An employé of the plant, named McCoy, picked up an ammonia bottle and shook it. He then extended it to Thompson with the mouth pointing to his face, when the cork flew out and the pure ammonia dashed into Thompson's face. His face, mouth, eyes, ears and nose were horribly corroded by the ammonia, and after some hours of most exquisite torture, Thompson died.

——The Bay St. Louis (Miss.) Ice Mfg. Co. began making ice in May last, but under the most discouraging circumstances. Shortly after starting the works, and before they had left the hands of the contractors, while the company were holding a meeting at the works, one of the ammonia joints was found to be defective, and while an attempt was being made to secure it it gave way, blowing the whole head of the drum to pieces. When the explosion took place there was a pressure of 215 pounds in the drum and eighty in the boiler. Mr. Lathrop, assistant constructing engineer, was thrown thirty feet by the explosion and knocked senseless, while Chief Engineer Armstrong, who was by his side, was frightfully scalded from head to feet. Both engineers were at the time so injured they were almost incapable of helping themselves, though Mr. Armstrong crawled out from under the house and getting back closed all the ammonia valves. John Dougherty, an engineer, who was looking on, displayed his presence of mind by rushing in and shutting off the steam, preventing further injury. Neither of the constructing engineers named was seriously hurt. The break was at once repaired, since which time the company has accepted the plant and been successfully making ice.

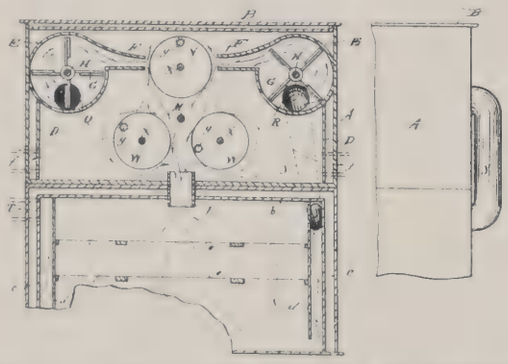
——The first of two fine cattle ships, built expressly for the Atlantic trade, arrived recently from England. There is room aboard for 900 head of cattle, 300 on each of the three decks, and there is room in the hold for 3,500 tons of other freight.



We append below the most important new patents, relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past two months, reported expressly for ICE AND REFRIGERATION.

COOLING APPARATUS.

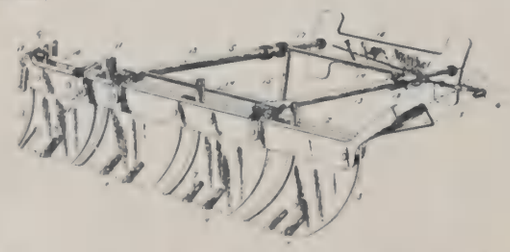
No. 449,615. Samuel B. Clemmens, Springfield, Ohio. Filed May 12, 1890. Serial No. 351,549. Patented March 31, 1891. (No model.)



Claim.—1. In a cooling apparatus, the combination, with the casing, of separate blast producing mechanisms mounted within the said casing, conduits for conducting the blasts, cooling chambers arranged to deflect said blasts and adapted to contain a cold producing substance and having a capped opening in each chamber adapted to communicate with the outside of the said case through suitable openings therein normally closed, whereby access may be had to each chamber to allow of filling and emptying the same, and suitable air inlet and outlet openings in said case for said air blasts.

ICE CUTTER.

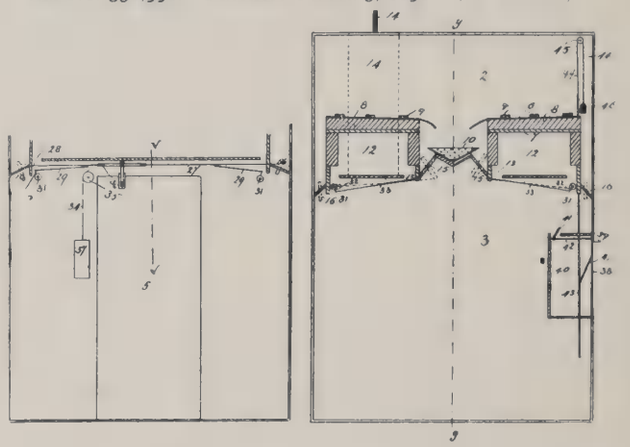
No. 449,516. Henry Bodenstein, Staatsburg, N. Y. Filed June 26, 1890. Serial No. 356,851. Patented March 3, 1891. (No model.)



Claim.—1. In an ice plow or cutter, the combination, with the frame, of the transverse bars or tubes, the longitudinal and inclined brace bars, the marker having the rods adjustable with relation to the said bars or tubes, the pivoted rod for engaging the marker proper to retain the same at a desired point, and the handle or lever for throwing the marker to opposite sides of the frame.

REFRIGERATOR.

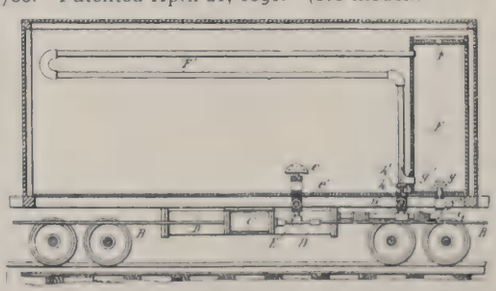
No. 447,403. David Gaul, Denver, Colo. Filed May 24, 1890. Serial No. 352,991. Patented March 3, 1891. (No model.)



Claim.—1. A refrigerator divided by a suitable partition into two compartments—namely, an upper portion forming the ice receptacle and a lower portion constituting the cooling chamber—the partition separating these compartments being provided with valves, a frame suitably supported and composed of rods having the form of a quadrilateral, the extremities of the rods being pivotally connected, extension rods connected with opposite sides of the pivoted frame and also connected with the valves in the partition, and an arm secured to the pivot located at one corner of said frame, said arm projecting outward, chamber 3 being provided with a door adapted to engage the free extremity of said arm, whereby the closing of the door moves the pivoted frame sufficiently to actuate the extension rods connected with the opposite sides of the frame, thereby opening the valves in the partition, substantially as described, and for the purpose set forth.

CAR REFRIGERATING APPARATUS.

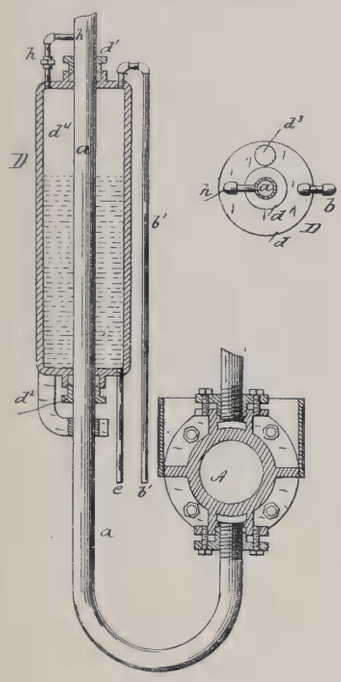
No. 450,976. William S. Parker, Pontiac, assignor of one-half to M. B. Mills, Detroit, Mich. Filed August 11, 1890. Serial No. 361,700. Patented April 21, 1891. (No model.)



Claim.—A refrigerating apparatus for railroad cars,

consisting of the combination, with the train pipe or other compressed air compartment of the air brake system, of a brine tank having circulating pipes in the car, an air storage chamber connected with the car and communicating with the said train pipe or compartment, a discharge pipe leading from the air storage chamber and connecting with the circulating pipes for conducting the air thereinto and refrigerating and causing the brine to traverse the brine tank and its circulating pipes, and means for regulating the rate of discharge through the discharge pipe, substantially as described.

OILING AND COOLING APPLIANCE.

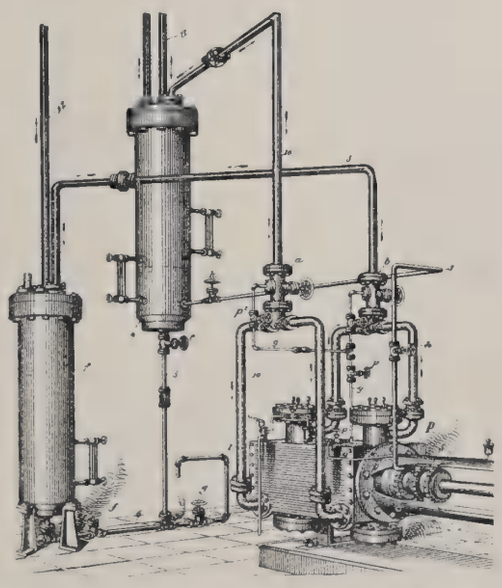


No. 452,534. Ehregott T. Winkler, Philadelphia, Pa., assignor, by mesne assignments, to the American Ice Machine Co. Filed September 20, 1887. Serial No. 250,218. Patented May 19, 1891. (No model.)

Claim.—In a refrigerant apparatus, the combination of an oil reservoir separate from and independent of the refrigerant circuit, the suction or low pressure pipe *a*, partly inclosed by said reservoir, a vent between the top of the oil reservoir and said suction pipe, a pump having around its piston rod an oil chamber connected by pipes with said oil reservoir to form an oil circuit between said reservoir and chamber, and means, substantially as described, for circulating the oil through said chamber pipes and reservoir.

APPARATUS FOR COOLING PUMPS.

No. 450,517. Charles G. Mayer, New York, N. Y. Filed December 29, 1886. Patented April 14, 1891. Serial No. 222,892. (No model.)

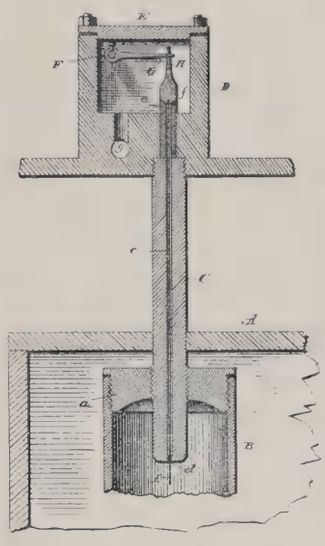


Claim.—1. The combination of the high and low pressure traps, the pipes 5, 6, connecting said traps together, a valve in each of said pipes, and the feed and discharge pipe *x*, communicating with said pipes 5, 6, between said valves, substantially as set forth.

REFRIGERATING VALVE.

No. 450,575. Charles A. Cox and Charles N. Brockington, Louisville, Ky., assignors of one-fifth to J. Frank Cox, same place. Filed March 20, 1890. Serial No. 344,602. Patented April 14, 1891. (No model.)

Claim.—1. The combination, with the refrigerating compartment containing an expansion header, of a tube having an inner contracted opening communicating with said header, together with a valve located at the external end of said tube, substantially as set forth.



2. The combination, with the refrigerating compartment containing an expansion header, of a tube projecting into the header, together with a valve located at the external end of said tube, substantially as set forth.

3. The combination, with a refrigerating compartment containing an expansion header, of a tube having its inner contracted portion communicating with said header, together with a valve located at the external end of said tube and carrying a spindle extending through the tube and its contracted inner opening, substantially as set forth.

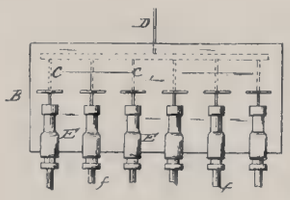
REFRIGERATING COMPOSITION.

No. 450,862. Robert R. Graf, Baltimore, Md., assignor of one-half to Ferdinand W. Reis, same place. Filed November 28, 1890. Serial No. 372,892. Patented April 21, 1891. (No specimens.)

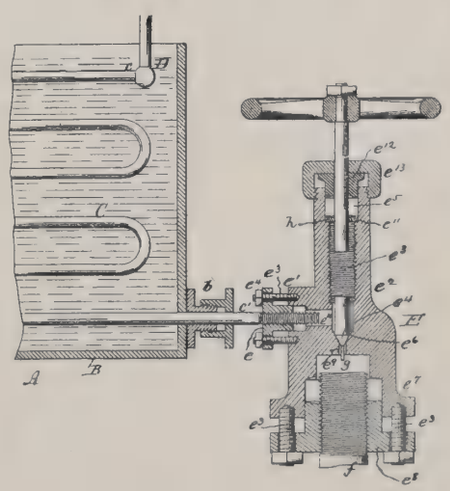
Claim.—The herein described refrigerating composition, consisting of a mixture of monocarbonate of soda, muriate of ammonia, nitrate of ammonia, nitrate of potash, potash alum, chloride of sodium and glycerine, in the proportions substantially as set forth.

CONDENSER COIL.

No. 452,535. Ehregott T. Winkler, Philadelphia, Pa., assignor, by mesne assignments, to the American Ice Machine Co. Filed September 20, 1887. Serial No. 250,219. Patented May 19, 1891. (No model.)



Claim.—In the circuit of an ice making or refrigerating apparatus, a valve having the outlet and inlet openings at angles to each other, and the latter provided with a plug seat, and said plug having a plunger of greater length than that part of the opening below the plug seat.

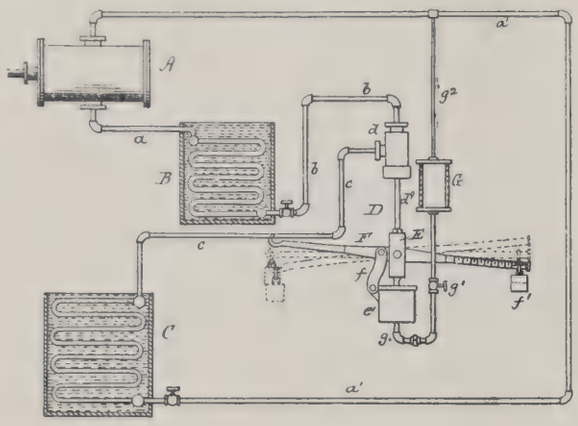


ICE MAKING MACHINE.

No. 452,536. Ehregott T. Winkler, Philadelphia, Pa., assignor, by mesne assignments, to the American Ice Machine Co. Filed September 20, 1887. Serial No. 250,220. Patented May 19, 1891. (No model.)

Claim.—In a refrigerating apparatus, the combination of a high and low pressure pump, a condenser having pipe connection with the high pressure side of the pump,

an outlet pipe for the condenser, having a flow valve, an evaporator having pipe connection at one end with the condenser outlet pipe and at the other with the low pressure side of the pump, and a governor engaging at

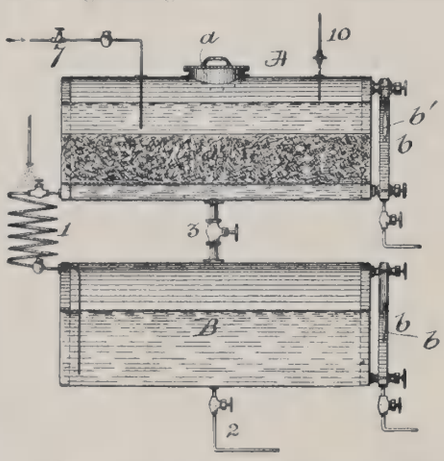


one end with said flow valve and connected at the other end with the pipe between the evaporator and the low pressure side of the pump, the pressure in said pipe actuating the governor to control the flow valve, substantially as set forth.

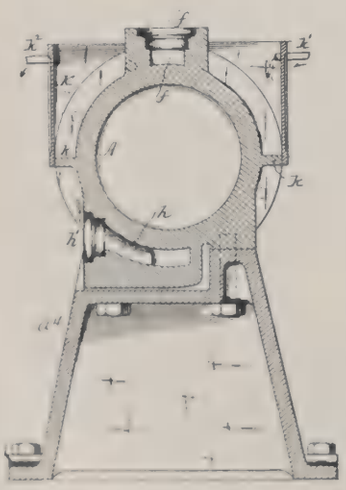
REFRIGERATING MACHINE.

No. 451,393. George H. Holgate, Atlanta, Ga. Filed February 4, 1890. Serial No. 339,212. Patented April 28, 1891. (No model.)

Claim.—1. In a refrigerating device of the described class, the combination of the absorber *A*, provided with a filter, the reservoir *B*, communicating with said absorber through the coil *1*, the heating receiver *D*, connected with the reservoir *B*, the intermediate force pump *C*, the coil *9* within said receiver *D*, the still connected at one end with the coil *9* and at the other with the receiver, and the tanks *d''* and *A'*, connected with the receiver and the still *E*, respectively, and connected with the absorber, substantially as and for the purpose specified.



COMPRESSION PUMP.

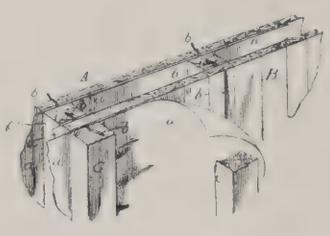


No. 452,537. Compression pump for ice making machines. Ehregott T. Winkler, Philadelphia, Pa., assignor, by mesne assignments, to the American Ice Machine Co. Filed September 20, 1887. Serial No. 250,221. Patented May 19, 1891. (No model.)

Claim.—In a refrigerating apparatus pump a working chamber having outlet ports in the upper side of a horizontal cylinder, inlet ports in the lower side of the cylinder, and all the ports closed by valves having their heads adjacent to the bore of the cylinder, and a water receptacle inclosing only the upper part of the horizontal cylinder.

REFRIGERATOR CAR OR BUILDING.

No. 453,047. Joseph F. Hanrahan, Detroit, Mich. Filed October 25, 1890. Patented May 26, 1891. Serial No. 369,303. (No model.)

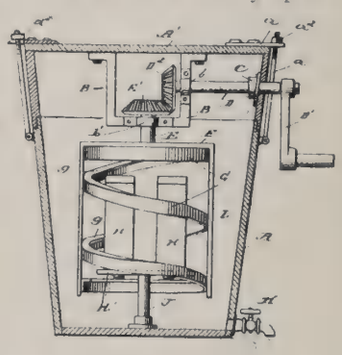


Claim.—In a refrigerator or like structure, the combination, with the sheathings *A B* and timbers *C*, dividing the wall into dead air spaces, of the layers of paper applied to the sheathings, and the cords or strings interposed between the timbers and sheathings and adapted to imbed themselves into the latter and into the paper.

ICE MACHINE.

No. 453,084. Thomas J. Lemon, New York, N. Y. Filed July 10, 1890. Serial No. 358,245. Patented May 26, 1891. (No model.)

Claim.—1. In an ice machine, the combination, with a tank and molds supported therein, of a rotary spiral strip surrounding the molds and forming an agitator, substantially as described.



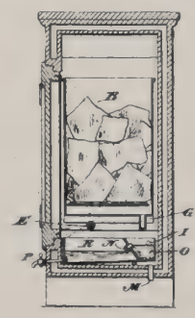
2. In an ice machine, the combination, with a tank and molds supported therein, of a spiral and flanged strip surrounding the molds, and means for rotating the strip, substantially as described.

3. In an ice machine, the combination, with a tank and molds supported therein, of a skeleton cylinder surrounding the molds and formed of an inverted U-shaped frame, etc.

REFRIGERATOR.

No. 454,747. Charles H. Leonard, Grand Rapids, Mich. Filed Nov. 22, 1890. Serial No. 372,371. Patented June 23, 1891. (No model.)

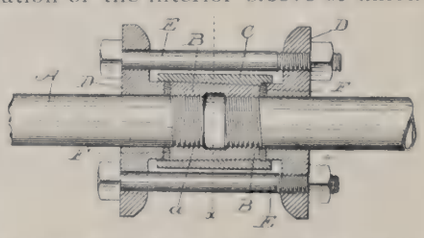
Claim.—1. A refrigerator consisting of a case containing a provision chamber and an ice receptacle chamber, a rod E, arranged horizontally in the base of the ice receptacle chamber in juxtaposition to the front portion thereof, and an ice receptacle B, provided at its bottom with base supports G, engaging the horizontal rod, so that the ice receptacle can oscillate thereupon as a center and when swung outward serve to close the front opening of the ice receptacle chamber and thereby prevent the exit of cold air, substantially as described.



PIPE COUPLING.

No. 438,752. Enoch Lawson, San Francisco, Cal., assignor of one-half to Phillip Leprohon, same place. Filed July 13, 1889. Serial No. 317,460. Patented October 21, 1890. (No model.)

Claim.—1. In a pipe coupling, substantially as described, the combination of the interior sleeve or union tapered upon its exterior and interiorly threaded to engage the threads of the pipe sections, the interiorly tapered outer sleeve adapted to be placed upon the sleeve B, the packing rings placed upon the pipes within the outer sleeve and against the ends of the inner sleeve, the flanges or disks also placed upon the sections of pipe and bearing against the packing rings and ends of the inner sleeve, and bolts connecting said flanges and adapted to draw them together, substantially as described, for the purpose set forth.



THIS ENGRAVING REPRESENTS THE WORKS OF THE

Blymyer Ice Machine Co., Cincinnati, Ohio.

Manufacturers of Ice and Refrigerating Machines, exclusively. The Absorption Machine, made by the Blymyer Ice Machine Co., is superior to any Compression Machine, either as a Refrigerating or Ice-Making Machine. It requires no steam engine or complex moving machinery. It saves 25 to 40 per cent of the fuel, and saves ammonia and labor. The cost of repairs is small, and the machine will outlast Compression Machines several times over. It is not necessary to buy these machines in pairs, as there is no danger of serious stoppage. These machines are ***RADICALLY DIFFERENT*** from all other Absorption Machines, and are in every way superior to them.



BELOW will be found a list of Ice-Making and Refrigerating Machines made by us. Every one of these machines has been in continuous use since erected, and is in use now. None have failed to fill their guarantees satisfactorily; none have been superseded by other machines. The entire capacity of our works having, up to the present time, been taken up with the manufacture of Ice-Making Machines, no agents have solicited orders for Refrigerators. Such orders as have been taken have been merely incidental. Having easily taken the lead in the Ice-Making Machine field, the manufacturers, with their enlarged capacity, will now enter the Refrigerator field (which is much the easier of the two in which to make a good record) in earnest, and respectfully solicit correspondence. Send for our catalogue.

ICE-MAKING MACHINES.

No.	Size.	NAME.	ADDRESS.
1	8 Ton.	Meridian Ice Mfg. Co.	Meridian, Miss.
1	10 "	Baton Rouge Ice Mfg. Co.	Baton Rouge, La.
1	15 "	Evansville Ice and Cold Storage Co	Evansville, Ind.
1	5 "	A. Moresi	Jeanerette, La.
1	15 "	Lookout Ice and Cold Storage Co.	Chattanooga, Tenn.
1	10 "	Morris Ice Co	Jackson, Miss.
1	15 "	Texarkana Ice Co	Texarkana, Tex.
1	30 "	Lookout Ice & Cld. Stor. Co. (2d Order)	Chattanooga, Tenn.
1	5 "	Gadsden Ice Co	Gadsden, Ala.
1	6 "	Sheffield Ice Co	Sheffield, Ala.
1	5 "	Decatur Ice Co	Decatur, Ala.
1	30 "	Crystal Ice Co	Wichita, Kan.
1	3 "	Denton Ice Co	Denton, Tex.
1	5 "	Van Buren Ice and Coal Co.	Van Buren, Ark.
1	5 "	Biloxi Artesian Ice Mfg. Co.	Biloxi, Miss.
1	25 "	Hutchinson Ice Mfg. Co	Hutchinson, Kan.
1	12 "	Parkersburg Ice Co	Parkersburg, W.Va.
1	30 "	Union Ice Co	Denver, Col.
1	3 "	Dominick & Karston	West Point, Miss.
1	3 "	DeCoppet Ice Co	Somerset, Ky.
1	35 "	Evansv'le Ice & Cld.Stor.Co.(2d Order)	Evansville, Ind.
1	2 "	Van Horn & Chambers	Lebanon, Ohio.
1	4 "	John C. Webb	Demopolis, Ala.
1	12 "	Huntington Ice and Storage Co.	Huntington, W.Va.
1	15 "	Corryville Artificial Ice Co.	Cincinnati, Ohio.
1	3 "	Tupelo Ice Co	Tupelo, Miss.
1	30 "	Wheeling Ice and Storage Co.	Wheeling, W.Va.
*1	10 "	Ft. Payne Ice and Cold Storage Co.	Ft. Payne, Ala.
*1	10 "	Coronado Beach Co. (Hotel del Coronado)	San Diego, Cal.
*1	1 "	Walter Aiken (Hamilton Hotel)	Hamilton, Bermuda
*1	20 "	Decatur Cold Storage and Ice Co.	Decatur, Ill.
*1	12 "	Marietta Ice Co	Marietta, O.
*1	35 "	Dayton Ice Mfg. & Cold Storage Co	Dayton, O.
*1	30 "	Zanesville Artificial Ice Co.	Zanesville, O.
*1	35 "	Evansv'le Ice & Cld.Stor.Co.(3d Order)	Evansville, Ind.
*1	3 "	Connolly & Curtis	Columbus, Miss.
*1	5 "	Lebanon Artificial Ice Co.	Lebanon, Ky.
*1	5 "	Cynthiana Elec. Light & Power Co	Cynthiana, Ky.
*1	5 "	Grenada Cream'y, Cld. Stor. & Ice. Co	Grenada, Miss.
*1	15 "	Washington Ice Co	Washington, Ind.
*1	30 "	Wheeling Ice & Storage Co. (2d Order)	Wheeling, W.Va.
*1	32 "	Consumers Ice Co.	San Francisco, Cal.
*1	15 "	Shelbyville Artificial Ice Co	Shelbyville, Ind.
*1	30 "	Pueblo Distilled Water Ice and Cold Storage Co.	Pueblo, Col.
*1	15 "	Skinner & Olson	Topeka, Kan.
*1	35 "	Fort Wayne Artificial Ice Co.	Fort Wayne, Ind.
*1	35 "	Evansv'le Ice & Cd. Stor. Co. (4th Order)	Evansville, Ind.
*1	55 "	Dayton Ice Mfg. & Cd. Sto. Co. (2d Order)	Dayton, O.
*1	15 "	Ashland Artificial Ice Co.	Ashland, Ky.
*1	50 "	Corryville Artificial Ice Co. (2d Order)	Cincinnati, O.

* These machines were erected in 1890.

ICE-MAKING MACHINES.

No.	Size.	NAME.	ADDRESS.
**1	8 Ton.	Gibson House	Cincinnati, O.
**1	10 "	Palace Hotel	San Francisco, Cal.
**1	30 "	The People's Ice Co	Birmingham, Ala.
**1	35 "	Citizens Ice Co.	Los Angeles, Cal.
**1	20 "	Civill & White	Colorado Spr'gs, Col.
**1	30 "	Pueblo D.W. Ice & Cd.S.Co. (2d Order	Pueblo, Col.
**1	60 "	Colorado Ice and Storage Co.	Denver, Col.
**1	25 "	E. B. Cornell	Tampa, Fla.
**1	5 "	Mr. H. G. Meumann	Bessemer, Ala.
**1	20 "	Consumers Ice Co.	Vicksburg, Miss.
**1	35 "	Artificial Ice and Storage Co.	Canton, O.
**1	12½ "	Frigid Ice Mfg. Co.	Joplin, Mo.
**1	30 "	Crystal Ice Co.	Albuquerque, N. M.
**1	15 "	Meridian Ice Co. (2d Order)	Meridian, Miss.
**1	5 "	Dayton Ice Co.	Dayton, Tenn.
**1	15 "	Decatur Ice Co. (2d Order)	Decatur, Ala.
**1	12½ "	The Ruddick Artificial Ice Co.	Columbus, Ind.
**1	10 "	Mr. August Erath	New Iberia, La.
**1	55 "	The Crystal Ice Mfg. & Cd. Sto. Co.	Columbus, O.
**1	32 "	Cousumers Ice Co. (2d Order).	San Francisco, Cal.
**1	15 "	Peru Ice and Cold Storage Co.	Peru, Ind.
**1	55 "	The Crystal Ice Mfg. and Cd. Stor Co. 2d Order)	Columbus, O.
**1	32 "	Lafayette Artificial Ice Co.	Lafayette, Ind.
**1	50 "	R. T. McDonald & Judah Hart	New Orleans, La
**1	12 "	John Hoey (Hollywood Hotel)	Long Branch, N. J.
**1	15 "	Bridgeport Electric and Ice Co.	Bridgeport, Ala.
**1	5 "	Fleischman & Co	Cincinnati, O.

** These machines were erected in season 1891.

REFRIGERATING MACHINES.

2	50 Ton.	Louisiana Brewing Co.	New Orleans, La.
1	40 "	Toledo Brewing and Malting Co.	Toledo, O.
1	40 "	Hudepohl & Kotte (Brewery	Cincinnati, O.
1	50 "	Savannah Brewing Co.	Savannah, Ga.
1	25 "	Schantz & Schwind (Brewery	Dayton, O.
1	15 "	John Smith's Sons (Brewery)	Youngstown, O.
1	12 "	Christ Diehl (Brewery)	Defiance, O.
1	12 "	Genessee Oil Works	Buffalo, N. Y.
1	12 "	S. Davis, Jr., & Co. (Packers)	Cincinnati, O.
1	50 "	Occidental Packing & Provision Co	Lincoln, Neb.
1	15 "	Thos. McFadden, Jr. (Cold Storage	Pittsburgh, Pa.
1	15 "	Grocers' Supply Co. (Cold Storage)	Pittsburgh, Pa.
*1	40 "	Adolph Coors (Golden Brewery	Golden, Col.
*1	20 "	F. Conrad (Brewery)	Anaheim, Cal.
*1	25 "	The Sachs-Prudens Ale Co	Dayton, O.

* These machines were erected in 1890.

DIRECTORY OF

Ice Factories, Ice Dealers and Cold Storage Houses.

THE PICTET ICE WORKS,
Manufacturers of Artificial Ice from Filtered and Double Distilled Lake Erie Water.
Capacity, 30 tons per day.
20, 22 & 24 Center St., Cleveland, O.

THE WASHINGTON MARKET CO.
Central, accessible and close to business, with over 300,000 feet cold storage space.
Center Market: 7th and Pa. Ave., N. W.,
Washington, D. C.

CENTRAL ICE CO.
REPRESENTING Lookout Ice & Cold Storage Co.
Chattanooga Ice & Bottling Co.
Ice Capacity, Big Spring Ice Co.
125 Tons daily. Chattanooga, Tenn.

NORTHWEST COLD STORAGE & ICE CO.
WM. MCGUIRE, Sec'y and Treas.
C. H. PRESCOTT, Pres. J. C. LEWIS, Vice-Pres.
WM. MCGUIRE, Mgr. Portland, Ore.

STANDARD ICE CO.
Daily capacity, 135 tons.
Office: Wall Street.
Factories: Atlanta, Iceville and West End.
MORRIS BENJAMIN, Mgr. Atlanta, Ga.

J. WALTON CURTIS,
ICE BROKER,
Ice bought and sold on commission.
P. O. Box 1264. Boston, Mass.

EXCELSIOR ICE & COLD STORAGE CO.
Ice capacity, 80 tons daily.
W. H. HOWE, Prop. Nashville, Tenn.

GEORGIA ICE CO.---N. O. ICE MFG. CO.
Capac'y, 40 tons daily. Capac'y, 80 tons daily.
J. M. BEATH, Gen. Mgr. H. H. BLANK, Supt. N. O.
Atlanta, Ga. New Orleans, La.

JAMES McCARTHY & SON,
Wholesale and Retail dealers in Ice.
Winter and Summer Shipments,
Lake Bras D'Or, Nova Scotia.

GIFFORD BROS.

HUDSON, NEW YORK.

ICE

ELEVATING
CONVEYING
LOWERING

Send for Catalogue and Price List.

MACHINERY

ALSO

CHAIN FORGINGS, ENGINES AND BOILERS.

SEIBEL-SUESSDORF

COPPER AND IRON MFG. CO.
MANUFACTURERS OF

Sheet Iron Tank Work

FOR ICE FACTORIES, PACKERS, ETC.

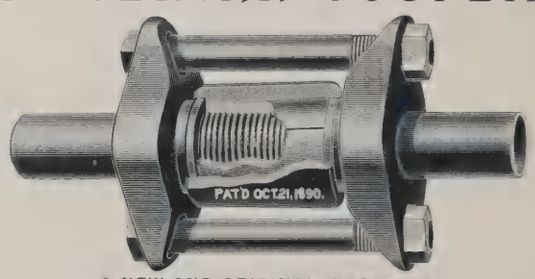
Also Manufacturers of Galvanized Iron

ICE CANS

SEND FOR ESTIMATES.

N. E. CORNER SECOND AND LOMBARD STREETS. ST. LOUIS, MO.

THE CLIMAX COUPLING



A NEW AND ORIGINAL INVENTION.
Unsurpassed for Efficiency, Strength, Durability and Economy.
Investigation will establish its superiority over every other known pipe-joint, particularly for Ice and Refrigerating Plants using ammonia.
For further information, testimonials, prices, etc., address

ENOCH LAWSON,
229 FULTON STREET,
SAN FRANCISCO, CAL.

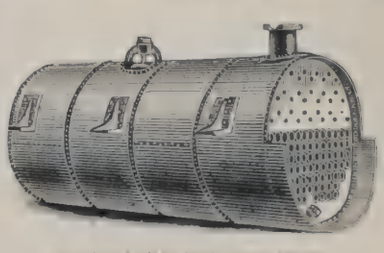
LANSING-IRON AND ENGINE-WORKS

LANSING, MICH.



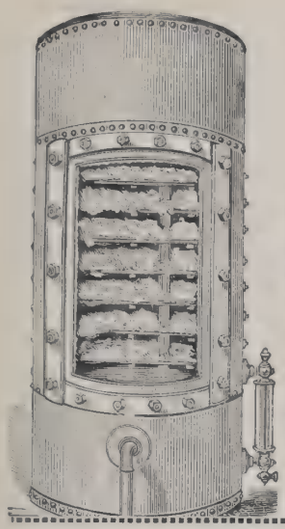
MANUFACTURERS OF

COMPOUND
CONDENSING
AUTOMATIC
ENGINES.



BOILER AND SHEET IRON AND TANK WORK

For Ice Makers and Cold Storage Plants a Specialty.



NEW FEED-WATER PURIFIER AND HEATER

USES LIVE STEAM

This cut shows our Feed Water Heater and Filter combined. Perfectly purifies the feed-water and delivers it to the boiler freed from scale producing elements and sediment. FULLY GUARANTEED.

STILWELL'S PATENT IMPROVED

Lime Extracting Heater. Uses Exhaust Steam. Separates the oil from the Steam and Water. It Regulates the Feed. The Pipes Never Pound. Prevents Scale in Steam Boilers, removing all Impurities from the water before it enters the Boiler.

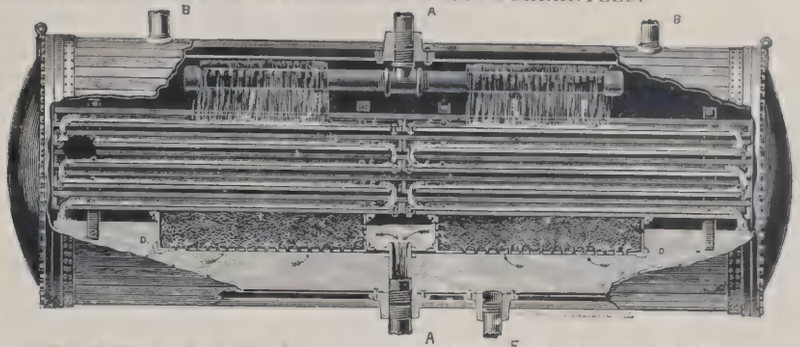
THOROUGHLY TESTED.

Over 4,500 of them in daily use.

This upright view is a fac-simile of the appearance of the shelves of a No. 5 Heater at work on ordinary Lime Water when the door was removed after the Heater had been running two weeks.

ILLUSTRATED CATALOGUE FREE.

ESTABLISHED IN 1866



STILWELL & BIERCE MANUFACTURING CO., DAYTON, O.

THE P. FLEMING COMPANY

A. TSCHOPIK & SON, Proprietors.

IRON PIPE, FITTINGS AND BRASS GOODS.

SEND FOR PRICE LIST AND DISCOUNTS.

A full line of Asbestos Rubber and other Packing suitable for Ice Machines.

CHATTANOOGA, TENN.

A. W. SWANITZ, CONSULTING ENGINEER,

AND EXPERT IN

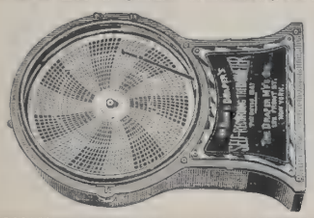
Ice and Refrigerating Machinery

CORRESPONDENCE SOLICITED . . .

701 STOCK EXCHANGE BUILDING,

CHICAGO.

DRAPER'S SELF-RECORDING THERMOMETER



This instrument is especially adapted for use in cold storage warehouses and freezing rooms, for keeping a correct and continuous record, in ink, of the temperature, affording absolute proof of the temperature maintained.

Size 14x20 in. Price, $30.
Size 9x14 in. Price, $15.
Write for particulars.

THE DRAPER MFG. CO.
152 Front St., NEW YORK.

Ice Machine Wanted.

A second-hand Ice Machine wanted at once; capacity from 10 to 25 tons; must be in good condition. Give full particulars. Address L. D. T., care ICE AND REFRIGERATION, 177 La Salle Street, Chicago, Ill.

JOHNSON, McCARTHY & JOHNSON,

MANUFACTURERS OF

THE JOHNSON COMPOUND

Ammonia Compressor

AND

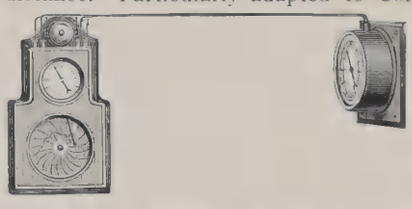
ICE AND REFRIGERATING MACHINES . . . . .

Office, Room 76 Worcester Block,

PORTLAND, OREGON.

Telemeter Instruments.

For recording and indicating temperature and pressure at a distance. Particularly adapted to Cold Storage, to indicate in the office or engine room the temperature in any or all the refrigerating rooms.



FOR DESCRIPTION AND PRICES SEND TO

STANDARD THERMOMETER CO.

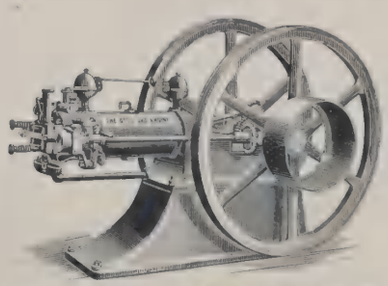
PEABODY, MASS.

New York Office, 18 Courtlandt St. Boston Office, 70 Pearl St.

OTTO

Gas and Gasoline Engines

OVER 3300 IN USE



BEST AND CHEAPEST POWER FOR

Refrigerating Machines

No Skilled Attendance.
No Boiler, Heat or Danger.
Started at once for short or long duty.
Sizes, ½ to 100 horse-power.
Can be used in country or city.

OTTO GAS ENGINE WORKS, 33d and Walnut Sts., PHILADELPHIA. 151 Monroe St., CHICAGO.

IMPORTANT TO ICE MAKERS.

⁂ TRI-SODIUM PHOSPHATE CHEMICAL WATER PURIFIER. ⁂

PATENTED

A staple salt for the purification of water, ***HOT*** or ***COLD***, free from injurious action to ice, water or metals.
It prevents incrustations in boilers, and yields an absolutely pure steam for condensing and freezing.
It will prevent incrustations or corrosion to cooling coils, when applied to water passing over them.

By its use the impurities are rapidly eliminated from hot or cold water, by precipitation in tanks, producing a clear, soft, wholesome water for freezing or other purposes.

Send for our book "Worth Knowing," containing valuable information on ***Water Treatment.***

KEYSTONE CHEMICAL COMPANY, Patentees and Manufacturers,

3 South Front Street, PHILADELPHIA. — 65 South Canal Street, CHICAGO.

STRONG TESTIMONY

KEYSTONE CHEMICAL CO.

CHAMPION ICE MANUFACTURING AND COLD STORAGE CO.
COVINGTON, KY., June 27, 1891.

Gentlemen: In answer to your inquiry as to how we like your Tri-Sodium Phosphate, will say that we have been using it for two years with the best of results, both here and at our plant in Ironton, O. We find that it keeps our boilers clean, and the condensed steam from them is absolutely pure and therefore does not effect the ice manufactured from it in the least. Condensed steam from boilers usually carries an insipid, smoky or bitter flavor with it into ice, but this is entirely overcome. We have the reputation of having the best artificially manufactured ice in this country; it is clear, odorless and tasteless, in fact absolutely pure, and we "bank" our last dollar on your Tri-Sodium Phosphate.

Yours truly,
(COPY) R. W. DUGAN, Sup't and Treas. CHAMPION ICE MFG. & COLD STORAGE CO.

CAPACITY 300 PER DAY.

ICE cans

"CANS" GALVANIZED IRON
WE MAKE THEM BY THE THOUSANDS FOR ICE MFRS. BREWERS AND FOR THE TRADE
READ TESTIMONIALS

WRITE FOR PRICES



WASHINGTON, D. C., November 29, 1890.

It gives us great pleasure to recommend your Ice Moulds to any one requiring a first-class Ice Can. Out of ***over two thousand*** cans in daily use for over six months we have not had a ***single leaky*** one yet. The ice blocks, 300 pounds in weight are discharged from them with great ease within a few minutes time, and the loss of shrinkage hardly perceptible.

J. Harrison Johnson, Pres't. THE HYGIENIC ICE CO.

MEMPHIS, TENN., November 24, 1890.

We write to ask the price of Ice Cans for next May delivery. Our experience with the cans bought of you the last year is so satisfactory, that we intend to give you our business in the future. Your cans have done well in the years' service, and, so far as we can see, they are as good as when built, material and workmanship on same being thoroughly honest and good evidence that you intend to remain permanently in the business, and do good, fair, square work.

BOHLEN-HUSE MACHINE & LAKE ICE CO.

SEE TESTIMONIALS NEXT ISSUE.



GROUND FLOOR SPACE 110 X 210 FT.

Established 1861. Incorporated 1890.

THE

KIECHLER MFG. CO.

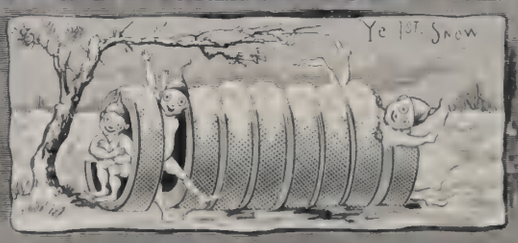
LINN, EVERETT and CLINTON STS.

CINCINNATI, O.

THE GARLOCK PACKING CO.

ELASTIC RING, SECTIONAL AND SPIRAL PACKINGS
ESPECIALLY ADAPTED FOR STEAM, WATER, AMMONIA AND ALL GASES
EQUALED BY NONE



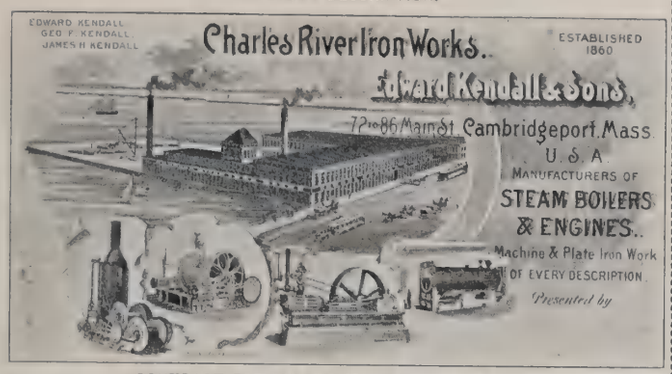




PALMYRA, N.Y. ROME, GA. OMAHA, NEB. — PITTSBURGH 54, 5th AVE — NEW YORK 194 WATER ST. — CHICAGO 94 FRANKLIN ST. — PHILADELPHIA 22 & 24 N. 4th ST. — PORTLAND, ORE.

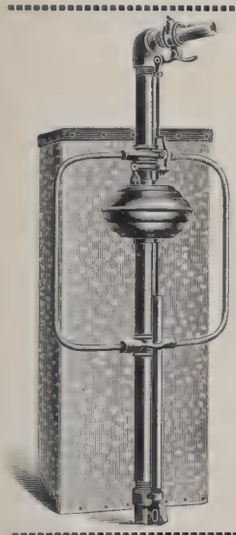
TANKS AND SHEET IRON WORK

OF EVERY DESCRIPTION.



CONTRACT FOR THE COMPLETE EQUIPMENT OF

ICE MAKING AND COLD STORAGE PLANTS.



E. C. SAULS. C. G. SAULS.

SAULS BROS.

MANUFACTURERS OF

Sauls' Automatic Ice Can Filler

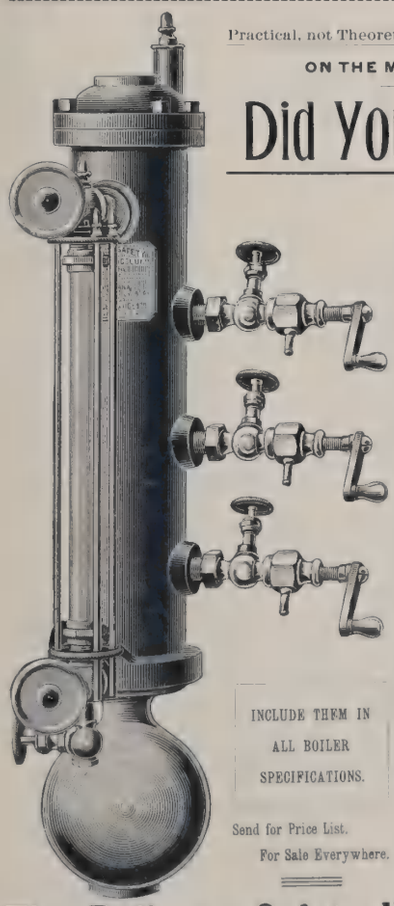
Fills Automatically and prevents flooding the bath. Save time, labor and money. Over

: : 150 : :

In use in prominent factories. Send for testimonials and prices.

SAULS BROS.

COLUMBUS, GA.



Practical, not Theoretical . . Over 15,000 in daily use.

ON THE MARKET SINCE 1884.

Did You Ever Stop

to think what
it means
to have the water
carried uniformly
at
the proper level?

IT MEANS
safety,
saving of fuel,
steady power,
and
more of it,
no leaky tubes,
no burned boilers,
no stoppage
for expensive repairs.

ALL
of
which

YOU CAN
secure
for
merely
nominal cost,

BY USING

INCLUDE THEM IN ALL BOILER SPECIFICATIONS.

Send for Price List.

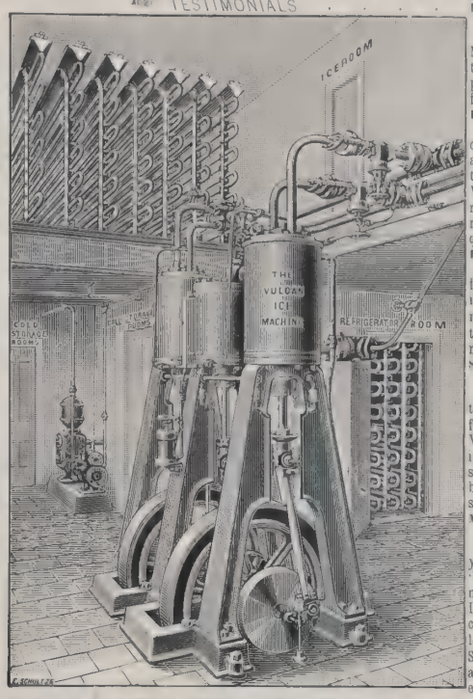
For Sale Everywhere.

The Reliance Safety Water Columns.

THE RELIANCE GAUGE CO.

101 EUCLID AVE., CLEVELAND, O.

The "VULCAN" Ice and Refrigerating Machine.



ENTERPRISE BREWERY, San Francisco:
"The 24-ton Refrigerating Machine has been running continuously since 1887, and has proved economical and satisfactory in every respect."

HOTEL DEL MONTE, Mont'y:
"The Ice Machine now in operation at Hotel Del Monte is and has been since its completion a very satisfactory plant. We take pleasure in cordially recommending this variety of machine to any who may require its use."

HOTEL RAFAEL, San Rafael:
"The 'Vulcan' Ice and Refrigerating plant is satisfactory in every respect, and is doing more work than was guaranteed. A model of good workmanship. The ice is clear."

SOUTH SAN FRANCISCO PACKING & PROV. CO.:
"It gives us pleasure to state that the Refrigerating plant furnished by the Vulcan Iron Works for our packing house, in 1886, has been in operation since then, and has given the best results, to our complete satisfaction."

MILK RANCH, Penn's Grove, Cal.:
"We have been for the past year, and are now using, a Vulcan Refrigerating Machine manufactured by the Vulcan Iron Works, for the purpose of cooling from 800 to 1,000 gallons of milk per day, shipped to San Francisco and San Rafael, and find the work done by it entirely satisfactory."

THE VULCAN IRON WORKS, 135-145 Fremont St., San Francisco, Cal.

WINGATE & MELL,

MANUFACTURERS OF : : : **ICE CANS**

WRITE FOR ESTIMATES.

44 & 46 North Broad Street, **ATLANTA, GA.**

SELDEN'S PATENT PACKINGS

FOR STUFFING BOXES



The BEST Packing for Ammonia, Air, Steam or Water. Used in Ice and Refrigerating Plants in this and other countries. Give it a trial. If your supply store does not keep it in stock, ask him to get it from the manufacturer.

RANDOLPH BRANDT,
38 Cortlandt St.,
New York, U. S. A.

....THE.... HEERDEGEN WATER INDICATOR

We make investigations for subterranean water and furnish reports as to the number of streams, their exact width, direction of flow, approximate depth below the surface, and quantity of flow.

The great advantage of having a well located, is:

1. We locate wells only at such places where we find subterranean FLOWING streams: this is a full guarantee of getting wells, which will never drop off or give out in time of draught, which is the case where wells are supplied by seepage water only.
2. We can follow the course of a subterranean stream for any distance and select the proper place to sink the well.
3. We state the approximate depth of the stream below the surface, which enables our customers to make an estimate of the cost for sinking the well by the foot.
4. Where the supply of an ARTESIAN WELL is obtained from a running stream or a spring, instead of seepage water, in NINE CASES OUT OF TEN IT IS OF GOOD QUALITY.
5. If there are any springs in the neighborhood where a well is wanted, we can trace the underground outlets of same or the supplying flow for any distance.
6. Where water of low temperature is wanted for cooling purposes, such as for BREWERIES, ICE FACTORIES, distilleries, oil refineries, etc., none cooler than artesian well water exists.
7. Our method of locating wells eliminates all and every risk of failure.

Estimates are given for sinking wells, with guarantee of water, where supply from artesian wells is desired.

We have successfully located a large number of wells.

For particulars apply to

HEERDEGEN & SCHNEE,

48 EXCHANGE PLACE, - - - NEW YORK.



AUG. OHLSEN. JOS. MECKLER.

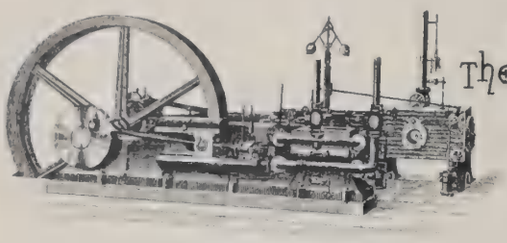
QUEEN CITY Omnibus and Wagon MFG. CO.

Builders of all Kinds of Vehicles

Cor. Charles and Plum Sts.,

CINCINNATI, O.

THEO. O. VILTER, Prest. & Supt.
ALBERT WALLBER, Vice Prest.
WM. O. VILTER, Secy. & Treas.



The Weisel & Vilter Mfg. Co.

Manufacturers of

CORLISS ENGINES,
Machinery for Brewers and Bottlers.

ICE MAKING & REFRIGERATING MACHINERY.

ICE-MAKING PLANTS

FOR BREWERIES, PACKING HOUSES, CONFECTIONERIES, COLD STORAGE HOUSES, ETC.

Direct Expansion or Brine System

MILWAUKEE, WIS.

Van Winkle Gin & Machinery Co.

E. VAN WINKLE, President.
J. WALLACE BOYD, Secretary.

MANUFACTURERS OF

THE KEELING ..AUTOMATIC.. ICE MACHINE

FOR ICE MAKING, COLD STORAGE PLANTS, BREWERIES, PACKERS, ETC.

WRITE FOR ESTIMATES AND FURTHER INFORMATION.

VAN WINKLE GIN AND MACHINERY CO.

OFFICE, 210 MARIETTA STREET, ATLANTA, GA.

ICE MACHINES

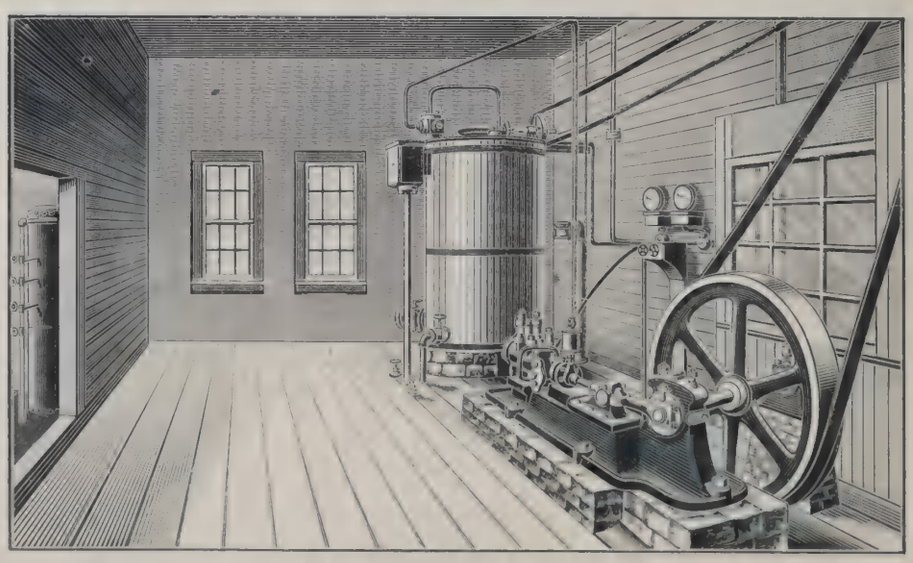
(WINDHAUSEN'S SYSTEM.)

AINSLIE, COCHRAN & CO.

LOUISVILLE, KY.

To the Trade . . . .

We have recently secured the sole right to manufacture and sell WINDHAUSEN'S CARBONIC ANHYDRIDE ICE AND REFRIGERATING MACHINES in the United States. These machines have gained a wide reputation on the continent for their simplicity, durability and economical running. They have been indorsed by the German government, an eighty (80) ton machine having been placed in the powder works at Spandau. They are also fast superseding other systems in the prominent breweries of Germany, nearly 200 being in operation already. They are the only machines using carbonic anhydride which has such a great range of expansion, produces such intense cold, and is cheap, odorless and easily obtained.



The above cut represents the No. 2 Machine at the Terre Haute House, Terre Haute, Ind.

WRITE TO US FOR FURTHER PARTICULARS

AINSLIE, COCHRAN & CO.

REFRIGERATING PLANTS

COLUMBUS IRON WORKS

IMPROVED

Absorption Ice Machine

SUCCESSORS TO
H. D. STRATTON & CO.

Established 1853.
Incorporated 1856.

W. R. BROWN, President.
W. COOK, Superintendent.

Machines from 5 to 33 tons capacity per 24 hours, or larger if desired.

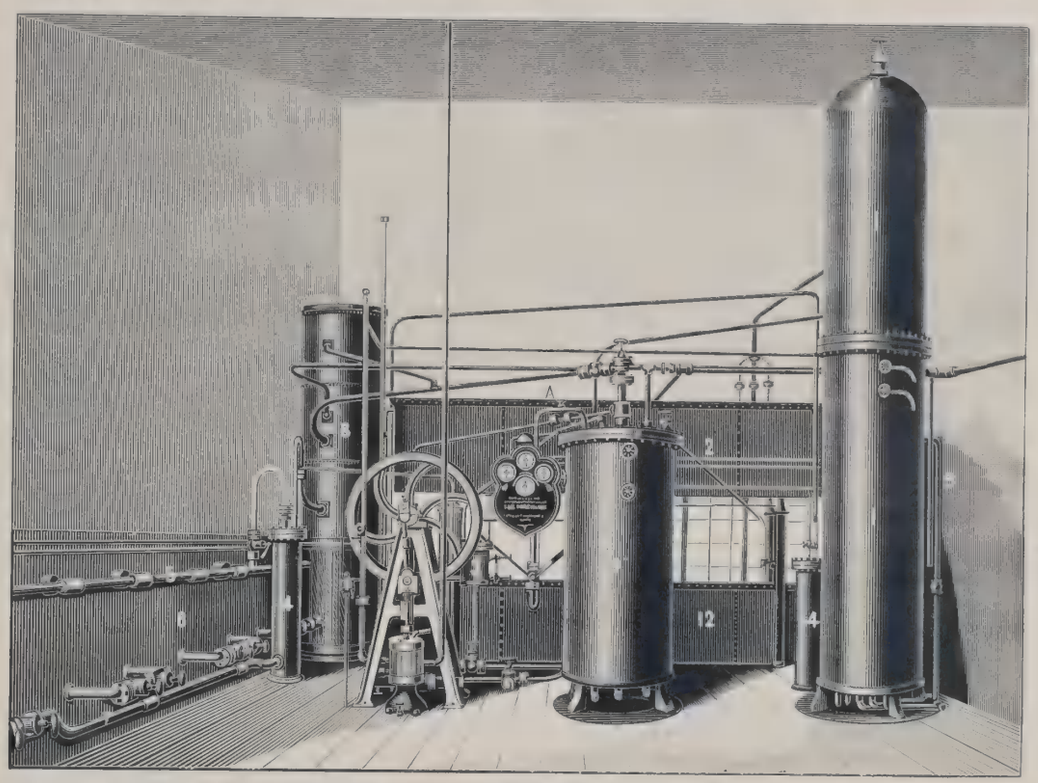
94 Machines Built
and all in successful operation.

More Ice Making Machines sold in the South than by any other establishment.

No expensive building required. No pressure on machine when stopped.

Send for price list and illustrated circular with location of machines.

This establishment was the first to turn out a perfect and complete Ice Machine, and has been in the business 21 years, constantly manufacturing and improving, and are prepared to furnish the most reliable and economical machine in the market.

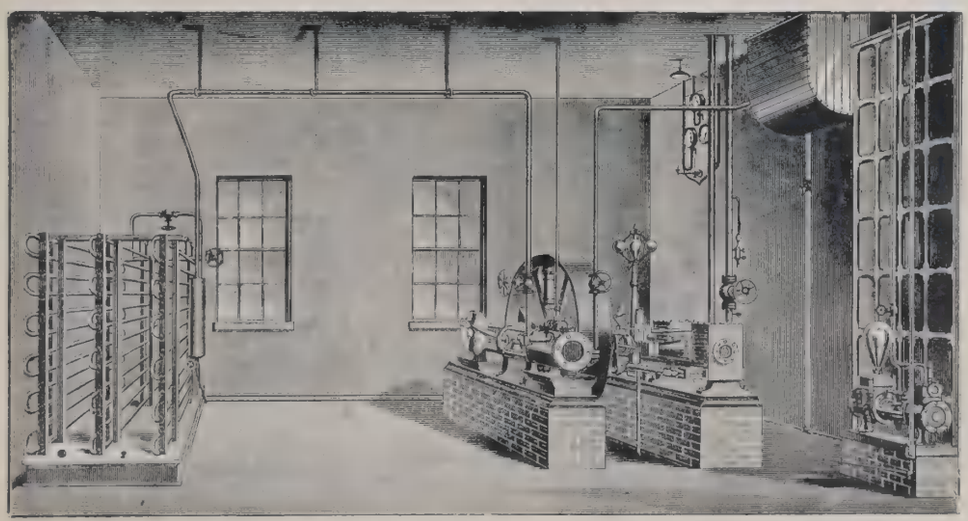


BUILT BY THE . . . **COLUMBUS IRON WORKS CO.** COLUMBUS, GA.

The American Ice Machine Company

SOLE OWNERS OF THE
KLINE AND WINKLER AUTOMATIC

REFRIGERATING AND ICE MAKING MACHINE SYSTEM



Simplicity of Construction,
Durability,
Efficiency,
Economy.

ICE-MAKING OR REFRIGERATING PLANTS

From One Ton to Two Hundred Tons daily capacity.

Over 100 MACHINES IN OPERATION.

1. **The simplicity of construction.** Every part is simple and complete, is exposed to full view, easily got at and can be readily understood and handled by an engineer of ordinary intelligence.

2. **The freezing process is completely automatic** (WHICH NO OTHER FREEZING SYSTEM POSSESSES), through the action of our patent evaporation pressure regulator; it saves valuable working time. Every part is independent of the other, and can be overhauled or replaced without stopping the whole machine.

3. **That ice is manufactured from distilled water,** which is free from disease-producing germs, such as abound in ice frozen on rivers and ponds, is chemically pure, and is infinitely preferable to the natural product.

4. **Our Patent Gas Condenser enables us to work with warmer water and less water** than any other machine, as the water is applied DIRECT on the hot pipe without waste or slop on the surroundings.

5. **We can make more ice or cold air** than any other machine, WITH THE SAME AMOUNT OF FUEL. Experts have placed the difference in our favor at not less than 25 degrees.

6. **The Condensers and Freezers** will not stop on account of sediment. They never require cleaning. They clean themselves while at work without separate attachment. Our freezing coils are so constructed that no pipe joint is used inside of the tank, and each coil is independent of the other. Each coil section can be taken out while working without interference with the other sections.

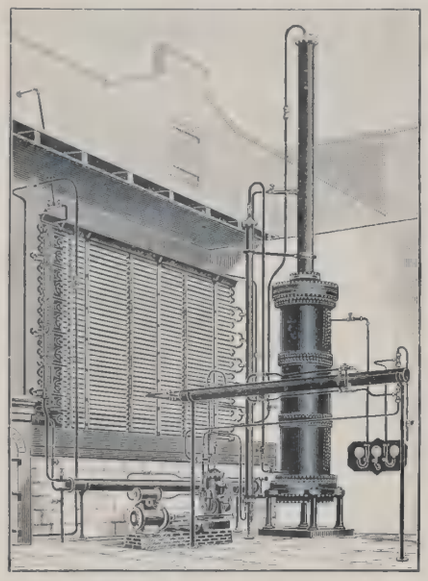
Company's Offices, 35 Broadway, Rooms 72, 73, 74 and 75, New York.

PENNSYLVANIA IRON WORKS COMPANY.

MANUFACTURERS OF RANKIN . . .

Ice and Refrigerating Machine

EMBODYING THE LATEST IMPROVEMENTS IN ABSORPTION MACHINES.



Ice Machine References

W. H. RAGAN, Thibodaux, La.
HENRY COOK, Donaldsville, La.
GEO. & J. G. MUEHLEBACH, Kansas City, Mo.
LAUER BREWING CO., Reading, Pa.
STEGMAIER & SON, Wilkes Barre, Pa.
J. H. MICHENER & CO., Philadelphia, Pa.
EDSON BROS. Cold Storage, Philadelphia, Pa.
"GLADSTONE" APARTMENTS, Philadelphia, Pa.
THOS. BRADLEY, Cold Storage, Philadelphia, Pa.
FRAISSI & BLUM, Ice Manuf'rs, Houma, La.

AND MANY OTHERS.

BUILDERS OF LATEST IMPROVED GREENE · ENGINE

Office and Works, 50th Street and Merion Avenue,

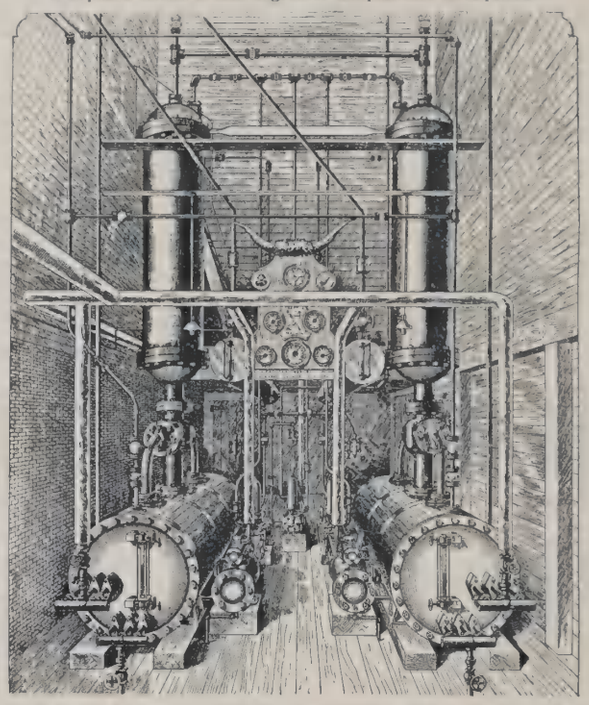
PHILADELPHIA, PA.

Ice and Refrigerating Machines

FOR . ICE-MAKING . PLANTS

Brewers, Pork Packers, Oil Refiners, Cold Air Store Houses, and all Purposes where a low degree of temperature is required.

Builder of Machinery for Packers, Butchers, and Produce Dealers.



Dealer in Engines, Boilers, Pumps and Steam Specialties.

ENGINEER AND CONTRACTOR

Descriptive Circulars, References, Detailed Estimates and Information furnished on Application . . . . . .

JAMES B. GRAFT, 74 CORTLANDT ST. NEW YORK.

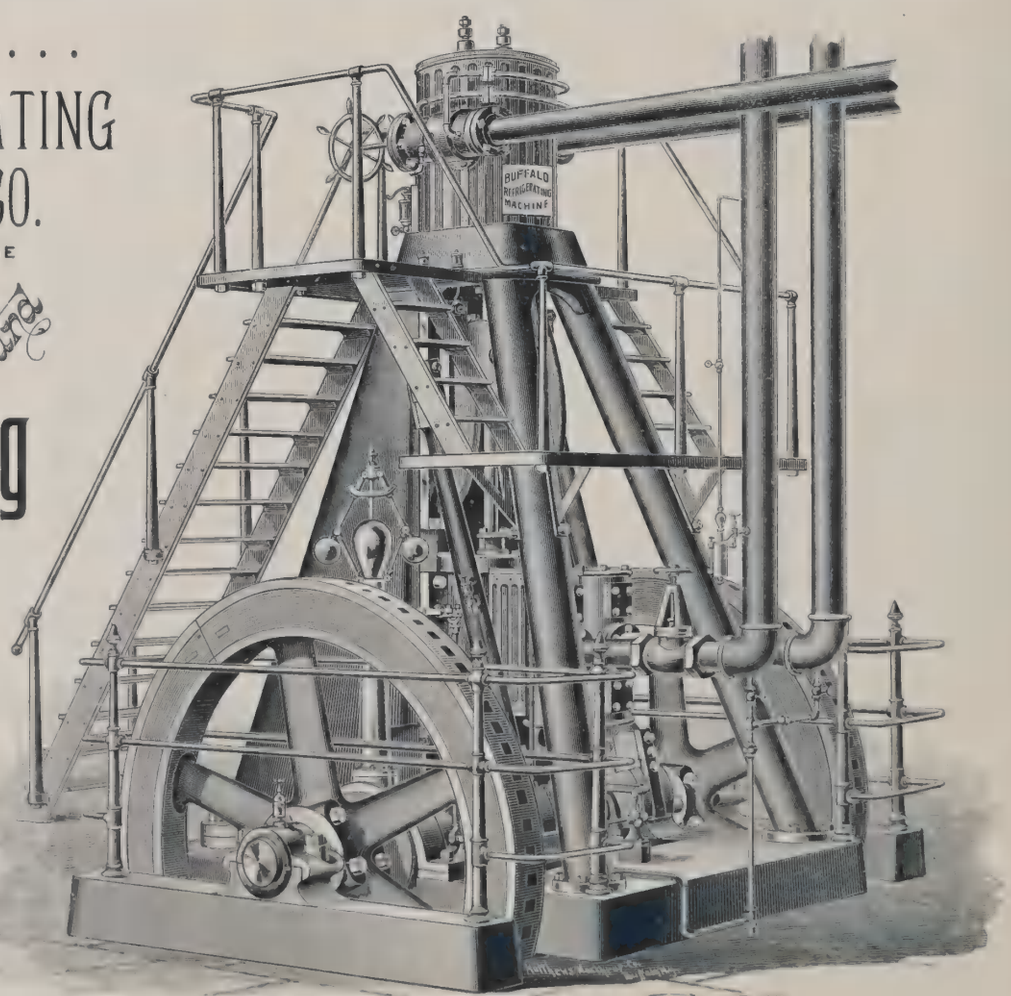
BUFFALO . . . . REFRIGERATING MACHINE CO.

BUILDERS OF THE

Buffalo Ice and Refrigerating MACHINE

For Ice Making and Artificial Refrigerating

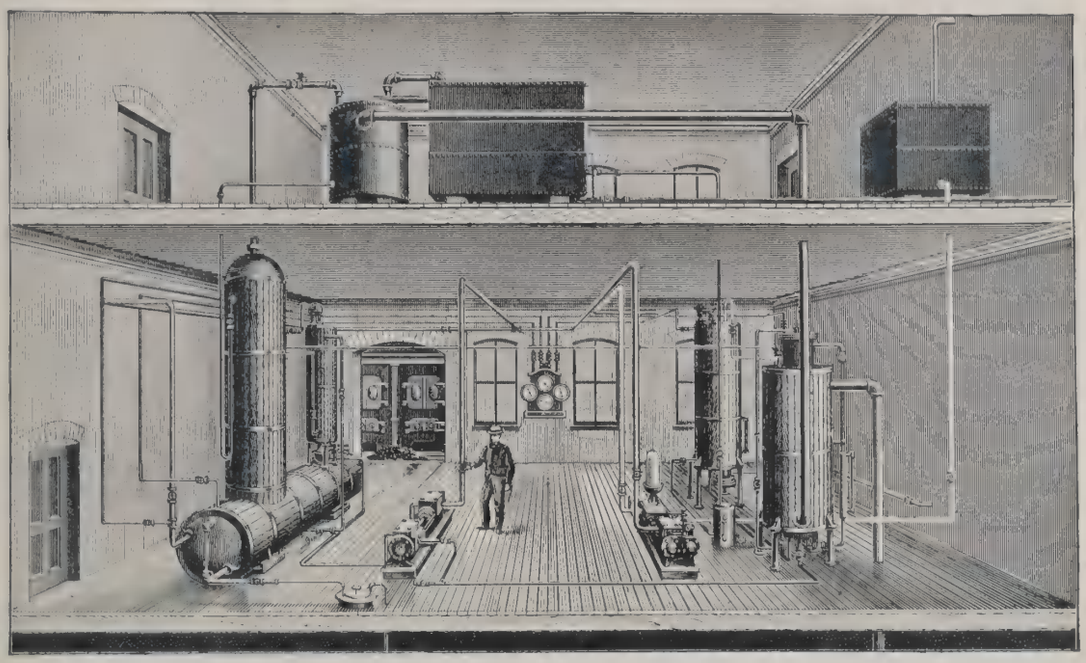
Full particulars, Estimates, Illustrated Circular, containing list of machines in use, etc., furnished upon application.



Buffalo, N. Y.

The Improved Pontifex-Wood Machine

A MOST ECONOMICAL AND RELIABLE APPARATUS.



Adapted to all classes of Refrigeration, especially where extremely low temperatures are required.

ALSO FOR

MAKING . . . ICE

UPWARDS OF

400

MACHINES IN OPERATION.

H. J. W. S. COOKE,
Patentee.

ESTIMATES FURNISHED.
SEND FOR CIRCULARS.

ISBELL-PORTER COMPANY, BUILDERS,

OFFICES

245 BROADWAY, NEW YORK. 46 BRIDGE STREET, NEWARK, N. J.

THE RICHMOND ICE MACHINE CO.

MANUFACTURERS OF

THE

MOST IMPROVED

ON THE COMPRESSION PLAN.

Ice-Making and Refrigerating Machinery

A WORD IN YOUR EAR

OUR MACHINES ARE GIVING SATISFACTION AND MAKING THE GUARANTEED AMOUNT OF PURE, SOLID, TRANSPARENT ICE. . . . . .

We have undoubtedly the BEST and SIMPLEST Machine on the Market.

We guarantee the proper working of our machinery. All working parts built to gauge, so they can be readily duplicated, and nothing but the very best material used. Specifications and estimates furnished

CORRESPONDENCE SOLICITED.

OFFICE, 1105 MAIN STREET,

WORKS . . . . .
MANCHESTER, VA.

P. O. BOX 315. **RICHMOND, VA.**

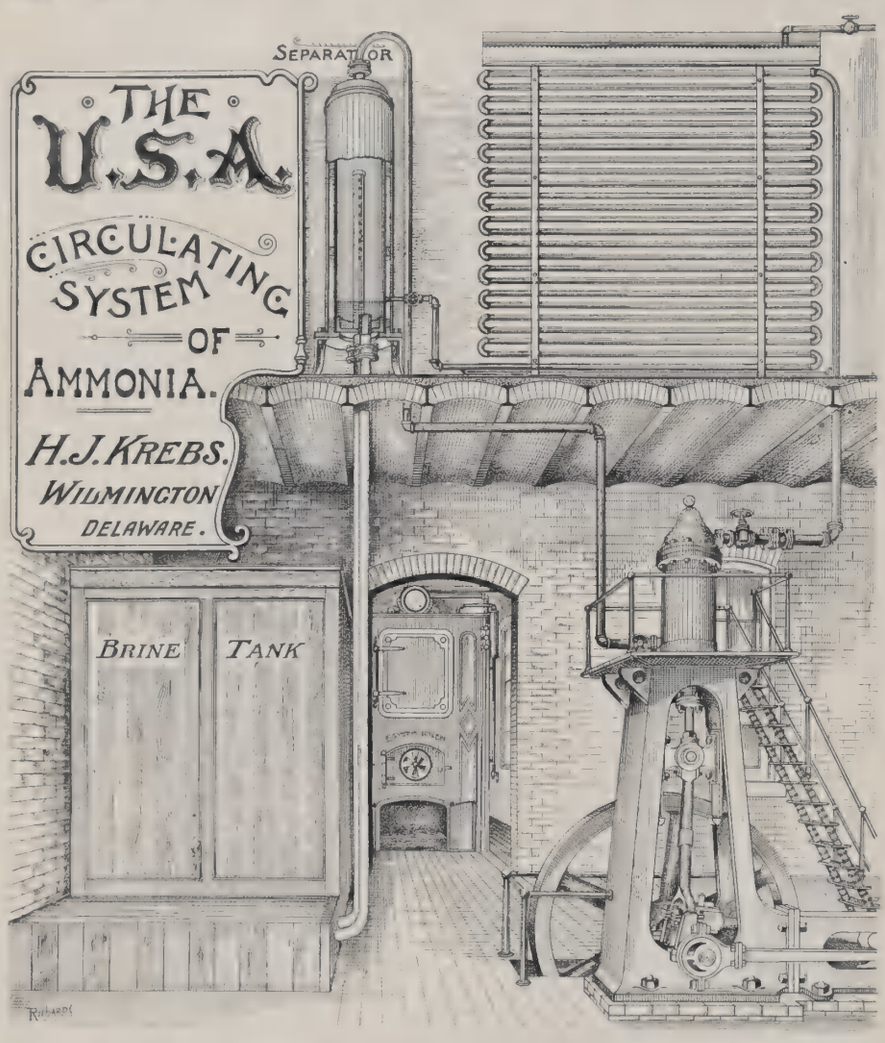
Send for our pamphlet "HOW TO MAKE AN ICE FACTORY PAY."

H. J. KREBS'

U. S. A. Circulating System of Ammonia

PATENTED SEPTEMBER 9th, 1890.

THE results achieved by this system, both for brine cooling and ice making, are unexcelled. It ensures dry gas to the pump and abundance of feed to the expansion pipes, therefore economy in piping, economy in ammonia and economy in space. It is simple and easily operated and saves time, money and worry. You cannot afford to do without it.



In Ordering Machines Specify the

·U·S·A·

CIRCULATING SYSTEM.

DURING LAST YEAR IT WAS INTRODUCED WITH GREAT SUCCESS IN THE FOLLOWING ESTABLISHMENTS:

Charles W. Street, Packing House, Baltimore, Md.
Washington Abattoir Co., - Bennings, D. C.
New Abattoir, Philadelphia Stock Yards, Philadelphia, Pa.
Wilmington Abattoir and Cold Storage Co., Wilmington, Del.
J. P. Bell & Sons, Ice Factory, - Norfolk, Va.

These Plants were Erected by Mr. J. C. Mustard, of 1818 N. 17th St., Philadelphia, Pa.

WRITE FOR PARTICULARS TO

H. J. KREBS,
MANUFACTURER,
WILMINGTON, DELAWARE.

J. C. MUSTARD,

1818 North 17th Street, Philadelphia, Pa.

—BUILDER OF

ICE MAKING AND REFRIGERATING MACHINES

DURING LAST YEAR I HAVE ERECTED THE FOLLOWING PLANTS:

∴ REFRIGERATING . MACHINES ∴

N. Autle, Pork Packer,	Washington, D. C.	Big Elk Dairy,	Oxford, Pa.
C. Spuck, Sausage Maker,	Baltimore, Md.	West Chester Dairy,	West Chester, Pa.
David Eichner, Pork Packer,	Baltimore, Md.	Chas. W. Street, Packing House,	Baltimore, Md.
J. F. C. Hansen, Pork Packer,	Baltimore, Md.	Washington Abattoir Co.,	Bennings, D. C.
Jos. J. Martin, Brandywine Dairies,	Cossart, Pa.	Wilmington Abattoir and Cold Storage Co.,	Wilmington, Del.
R. W. Downing, Wallingford Dairy,	Wallingford, Pa.	New Abattoir, Philadelphia Stock Yards,	Philadelphia, Pa.
H. B. & E. A. Pugh, Dairy,	Oxford, Pa.		

∴ ICE . PLANTS ∴

J. S. Bell & Sons, Ice Factory, Norfolk, Va. Suffolk Ice Co., Suffolk, Va.

The last named plant I am now about starting, having changed it from absorption to compression. A number of above plants are fitted with the U. S. A. Circulating System, which for efficiency, economy, and simplicity can not be surpassed. My long experience in the ice and refrigerating trade enables me to select the best, and I take especial pride in furnishing high grade machinery at moderate cost.

J. C. MUSTARD,

1818 North 17th St., Philadelphia, Pa.

CORRESPONDENCE SOLICITED.

THE WILSON-SNYDER MFG. CO.

MANUFACTURERS OF AUGUST SNYDER'S PATENT

Ice and Refrigerating Machine

SPECIALLY DESIGNED TO MEET THE DEMANDS OF ICE MAKERS AND REFRIGERATION IN ALL ITS APPLICATIONS . . . . . .



INTERIOR VIEW OF WORKS OF THE WILSON-SNYDER MFG. CO.

TWO styles of these machines are built: One, single acting compressor, with duplex condensers and brine tanks; the other, duplex compressor, condensers and brine tanks. The special advantages of this machine over all others are as follows: In either the single or duplex machine, either one of the brine tanks or condensers getting out of order, or anything happening to necessitate repair, the system of valves is so arranged as to allow using but one condenser or one brine tank, and the machine is kept running with the disabled part as though nothing had happened, while the disabled brine tank or condenser is being dismantled and repaired. Write for list of machines in operation, references, prices, etc. . . . . .

ALSO MANUFACTURERS OF IMPROVED . . . .

PUMPING MACHINERY

Including AIR PUMPS, BRINE PUMPS, HOT AND COLD WATER PUMPS, BOILER FEED PUMPS, TANK PUMPS, Etc.

Ammonia Valves, Pipe Coils and Pipe Fittings

.....OF EVERY DESCRIPTION .....

PITTSBURGH, PA.

THE DE LA VERGNE REFRIGERATING MACHINE CO.

MANUFACTURERS OF

Foot of East 138th Street (Port Morris.)

NEW YORK, U. S. A.

REFRIGERATING AND ICE MACHINES AND ANHYDROUS AMMONIA . . . .

Over

360

Machines are now in Successful Operation, Representing a Total Capacity Equal to the Melting of over

18,000

Tons of Ice Per day.



Machines are used for the Cooling of

Breweries, Abattoirs and Packing Houses, Markets and Cold Storage, Hotels and Restaurants, Chemical Works, Confectioneries, and Chocolate Manufactories, Steamship Holds, Wineries, Dairies,

AND FOR THE MANUFACTURE OF ICE

A FULL DESCRIPTION OF OUR SYSTEM AND APPARATUS WILL BE SENT TO PERSONS APPLYING FOR THE SAME.

CORRESPONDENCE FROM PARTIES DESIROUS OF CONTRACTING FOR PLANS IS SOLICITED.

Estimates and Proposals will be promptly furnished free of charge as soon as the requirements are made known to us.

PICTET

Ice and Refrigerating Machine

....MANUFACTURED BY....

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

WE DO NOT USE AMMONIA.

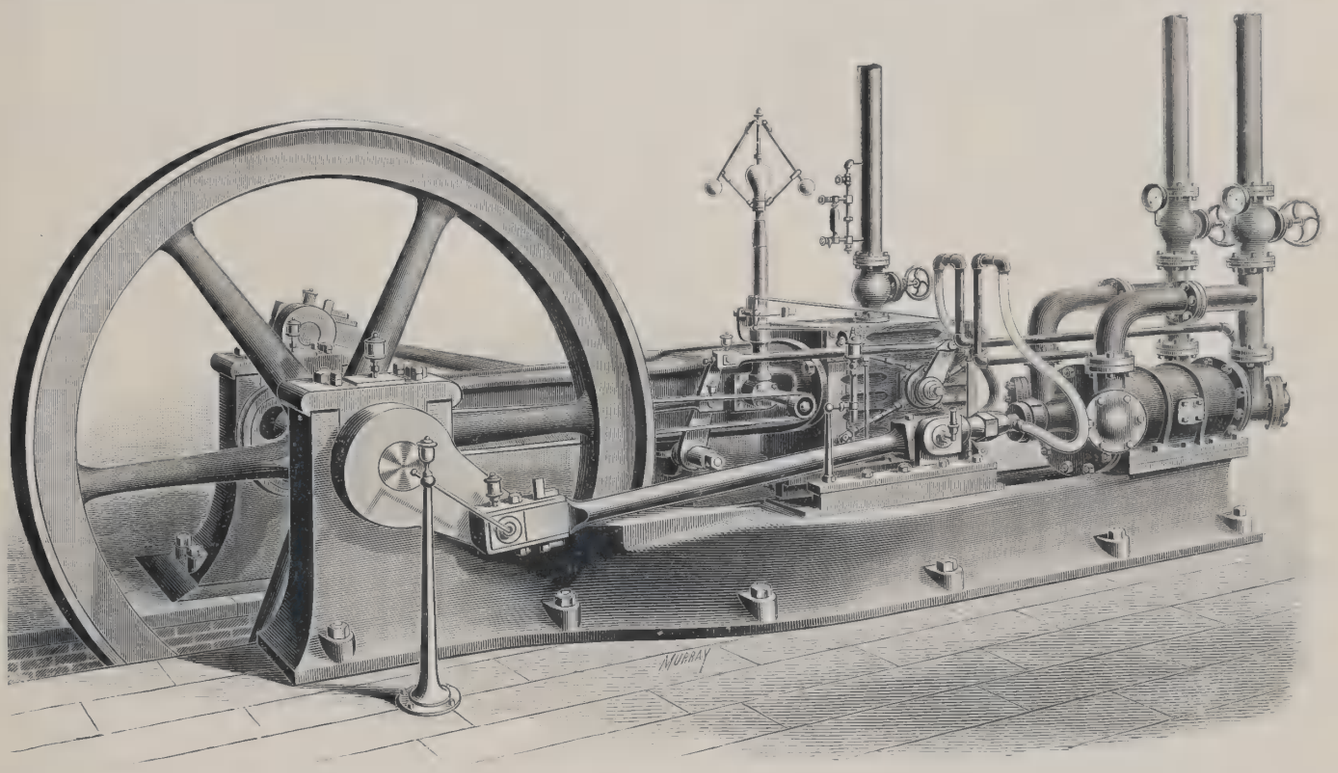
Pictet Machines use **Anhydrous Sulphurous Oxide,** a chemical noted for its low working pressure, is of itself a lubricant, and does not injure any of the metals; its low pressure is a guarantee against explosion.

NEW YORK BOARD OF FIRE UNDERWRITERS.
BUREAU OF SURVEYS
JAMES HARRISON, Supt.
Borcel Building, 135 Broadway, Room 37.

NEW YORK, January 24, 1891.

THE PICTET ARTIFICIAL ICE CO. (Limited), New York:

Dear Sirs: Your favor of the 22d inst. is at hand. In reply, the examination of our expert and his subsequent report were convincing that the article known as Anhydrous Sulphurous Oxide is a safe article for storage or shipment, its tendency being to extinguish rather than to cause fire. Yours truly, JAMES HARRISON, Supt.



Working Pressure from 50 to 75 lbs.

We guarantee GREATER ECONOMY OF FUEL, doing the same amount of work with less coal than any machine in the market.

FOR LIST OF REFERENCES AND FURTHER PARTICULARS, ADDRESS

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

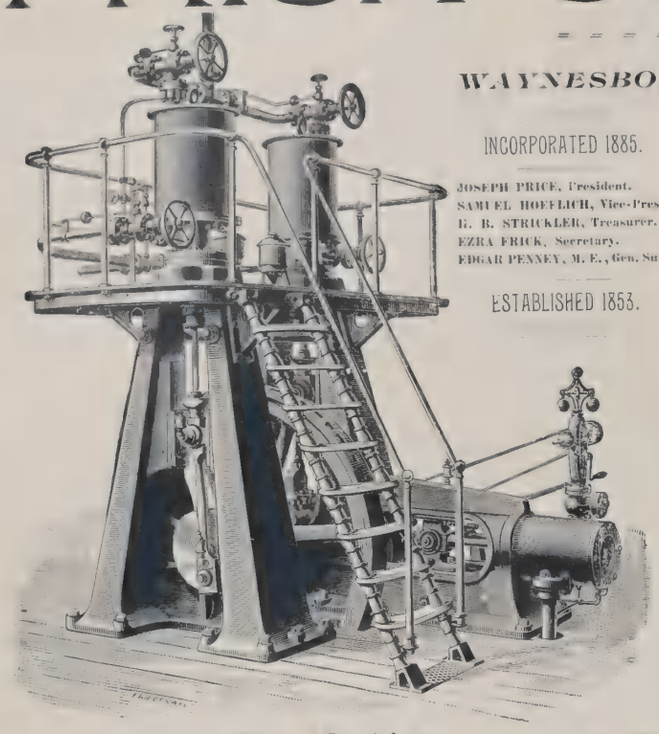
WORKS: NEWBURGH, N. Y.

New York Office, 21 Cortlandt St., Room 6.

FRICK COMPANY

ENGINEERS,

WAYNESBORO, FRANKLIN COUNTY, PA., U. S. A.



5-Ton Machine.

INCORPORATED 1885.

JOSEPH PRICE, President.
SAMUEL HOEFLICH, Vice-Pres.
E. B. STRICKLER, Treasurer.
EZRA FRICK, Secretary.
EDGAR PENNEY, M. E., Gen. Sup.

ESTABLISHED 1853.



MAIN WORKS AND GENERAL OFFICES: WAYNESBORO, PA.

CAPITAL, - - - - - - $1,000,000.

MANUFACTURERS OF THE

ECLIPSE

Ice Making and Refrigerating Machines.

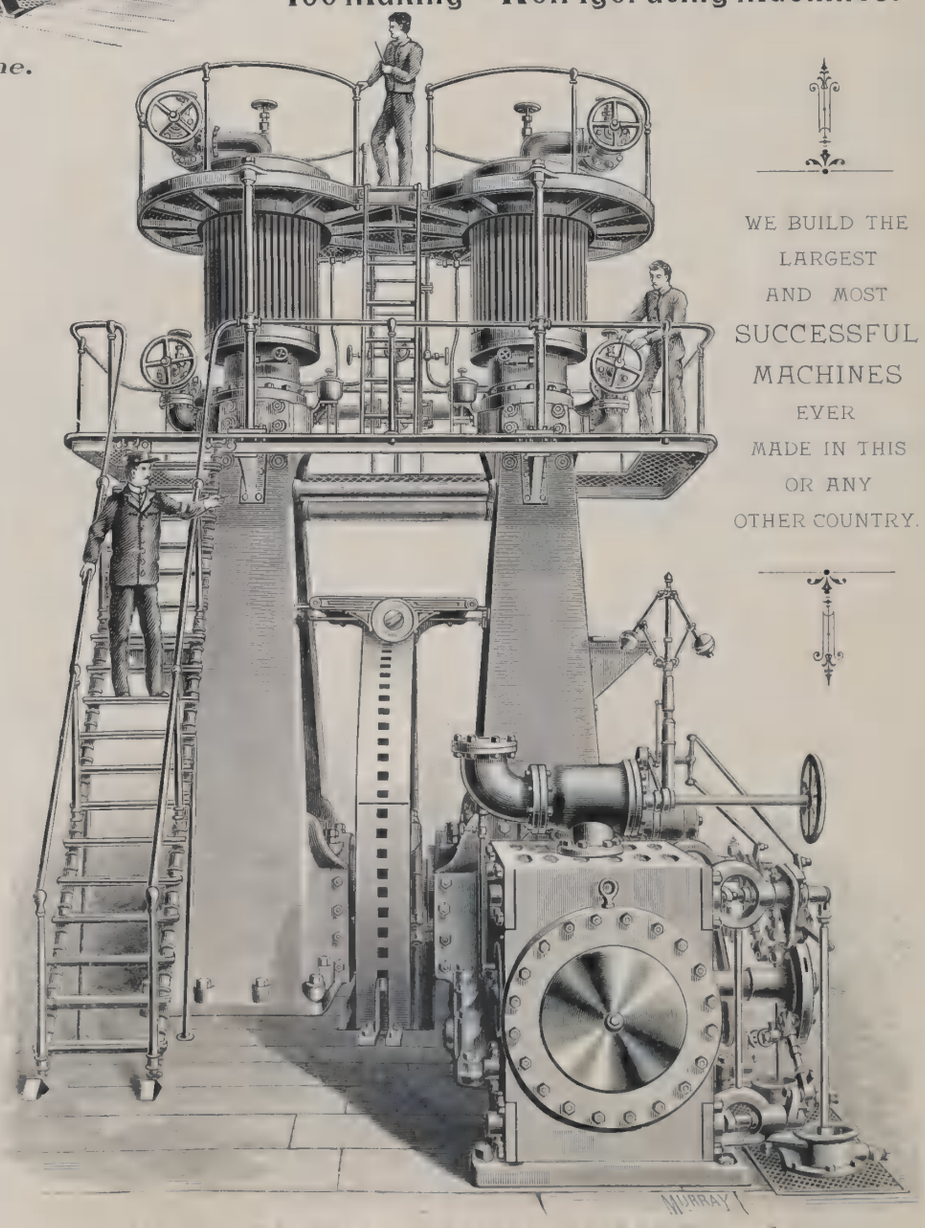
SEND FOR OUR NEW CATALOGUE, 1890.

A Few References:

BREWERIES.	Refrigerating. Tons.
Phoenix Brg. Co., Baltimore, Md.	27
Gipps Brg. Co., Peoria, Ill.	50
Sprattler & Mennell, Paterson, N. J.	32
Herman Lackman, Cincinnati.	65
Henry Fink, Harrisburg, Pa.	32
Sebastian Helldorfer, Baltimore, Md.	32
Frank Reisch & Bros., Springfield, Ill.	50
Jos. Stem & Co., Louisville, Ky.	23
Meyer & Reidlin, Covington, Ky.	32
Parkersburg Brg. Co., Parkersburg, W. Va.	27
Bellevue Brg. Co., Cincinnati, O.	50
Cumberland Brg. Co., Cumberland, Md.	27
D. Lutz & Son, Allegheny, Pa.	50
Herman Lackman, Cincinnati (2d order)	80

PACKING AND COLD STORAGE.	
J. C. Shafer & Co., Baltimore	40
G. Cassard & Sons, Baltimore	25
Baltimore City Storage Co., Baltimore	32
Armour Packing Co., Kansas City	100
Shallcross & Son, Coatesville, Pa.	15
Washington Market Co., Washington, D. C.	32
Armour Pckg. Co., Kansas City (2d order)	150
Francis Whittaker & Sons, Wichita, Kas.	150
Emil Winters, Pittsburgh, Pa.	37
Frank Seifrid, Louisville, Ky.	7
Chicago Packing & Provision Co., Chicago	150
Chicago Packing & Provision Co., Chicago (second order)	150
Steelton Store Co., Steelton, Pa.	10
Pittsb'gh Meat Supply Co., Allegheny, Pa.	50
J. Vogle & Son, Cincinnati.	50
John C. Hately, Chicago	65
G. H. Hammond & Co., Hammond, Ind.	150
G. H. Hammond & Co., Omaha, Neb	150
Calumet Canning Co., Hammond, Ind.	32
West Chester Cd. Stor. Co., W. Chester, Pa.	40
Chautauqua Lake Ice Co., Pittsburgh, Pa.	20

ICE FACTORIES.	Ice. Tons.
F. L. Ellis & Co., Hopkinsville, Ky.	10
Consumer Ice Co., New Orleans, La	100
Little Rock Ice Co., Little Rock, Ark.	35
Owensboro Ice & Cd. Stor. Co., O'sb'o, Ky	20
W. S. Larton, Jacksonville, Ill.	15
Pulaski Ice Co., Pulaski, Tenn.	5
Armour Packing Co., Kansas City	75
Ewing & Beall, Uniontown, Pa.	15
S. W. Hill, Allegheny, Pa.	18
Chautauqua Lake Ice Co., Pittsburgh.	40
Chautauqua Lake Ice Co., Pittsburgh (2d order)	40
West Chester Ice Co., West Chester, Pa.	15
Steelton Store Co., Steelton, Pa.	2
Parkersburg Brg. Co., Parkersburg, W. Va.	3
Cumberland Brg. Co., Cumberland, Md.	8
Hagerstown Ice Co., Hagerstown, Md.	20
Alberto Malo, City of Mexico, Mex.	25
Germantown Ice Co., Germantown, Pa.	20
Bryn Mawr Hotel Co., Bryn Mawr, Pa.	20
Geo. S. Sexton & Co., Wytheville, Va.	5
Cambridge Ice Co., Cambridge, Md.	10

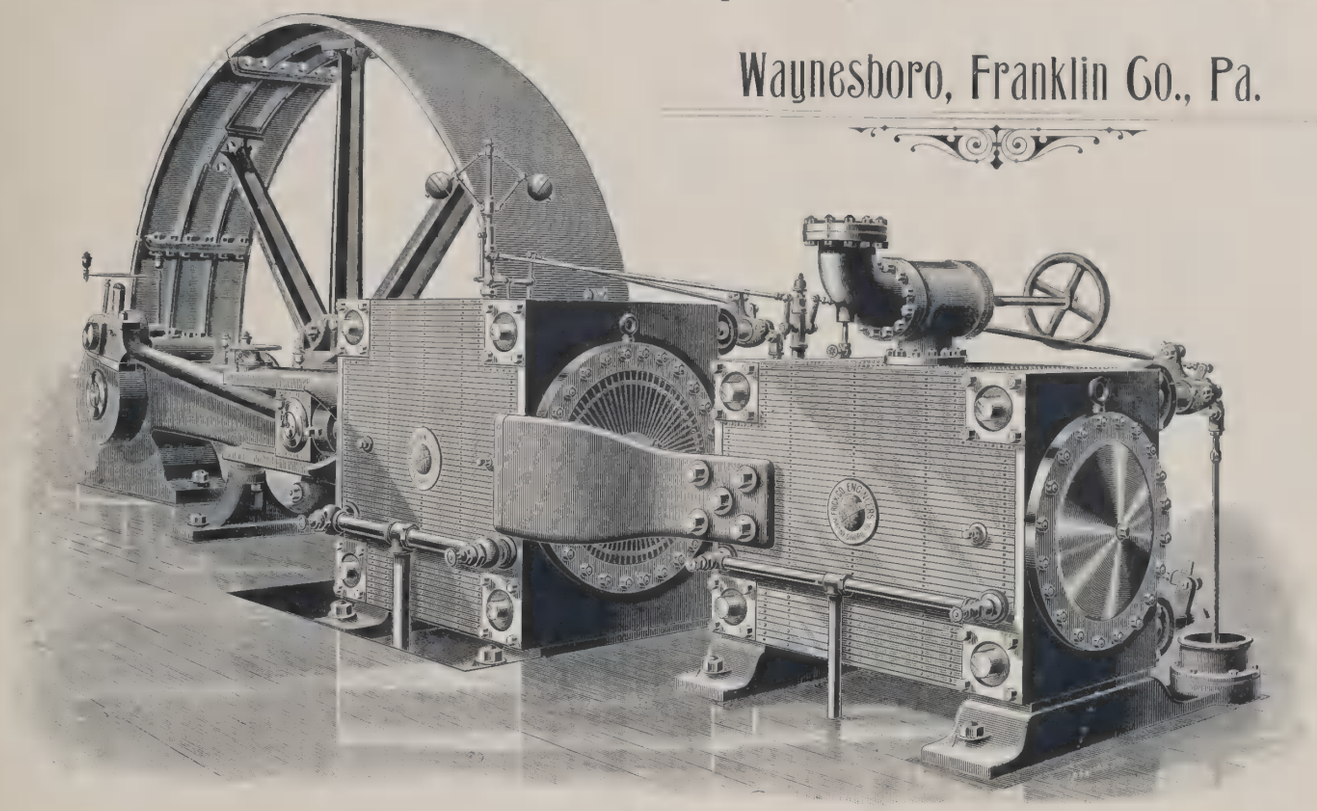


150-Ton Machine. Weight, 193,250 Pounds.

WE BUILD THE LARGEST AND MOST SUCCESSFUL MACHINES EVER MADE IN THIS OR ANY OTHER COUNTRY.

FRICK COMPANY, ENGINEERS,

Waynesboro, Franklin Co., Pa.



A GENUINE CORLISS ENGINE WITH ALL THE LATEST IMPROVEMENTS.

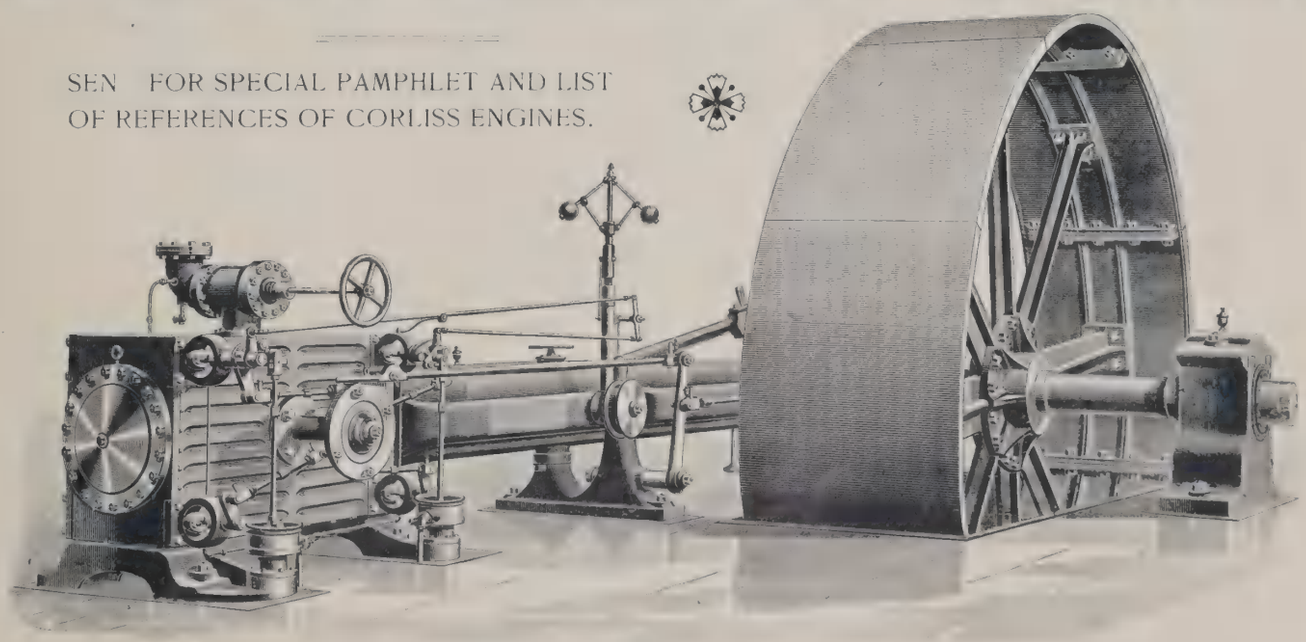
"EGLIPSE" CORLISS TANDEM COMPOUND CONDENSING ENGINE

UP TO 3000 HORSE POWER

We have complete line of patterns and build Corliss Horizontal Stationary Engines, Corliss Vertical Engines, Condensing or Non-Condensing, Single or in Pairs. Corliss Compound Engines, Tandem or Cross Compound. Corliss Engines for any service, 40 to 3000 horse power, in a single engine.

SPECIAL NOTICE.—With our Corliss Engine we contract for fitting up complete the entire Steam Plants, including Steam Boiler, Feed Water Heater, Feed Pumps, Piping, Shafting, and all the appurtenances and belongings peculiar to a first-class job.

SEN FOR SPECIAL PAMPHLET AND LIST OF REFERENCES OF CORLISS ENGINES.



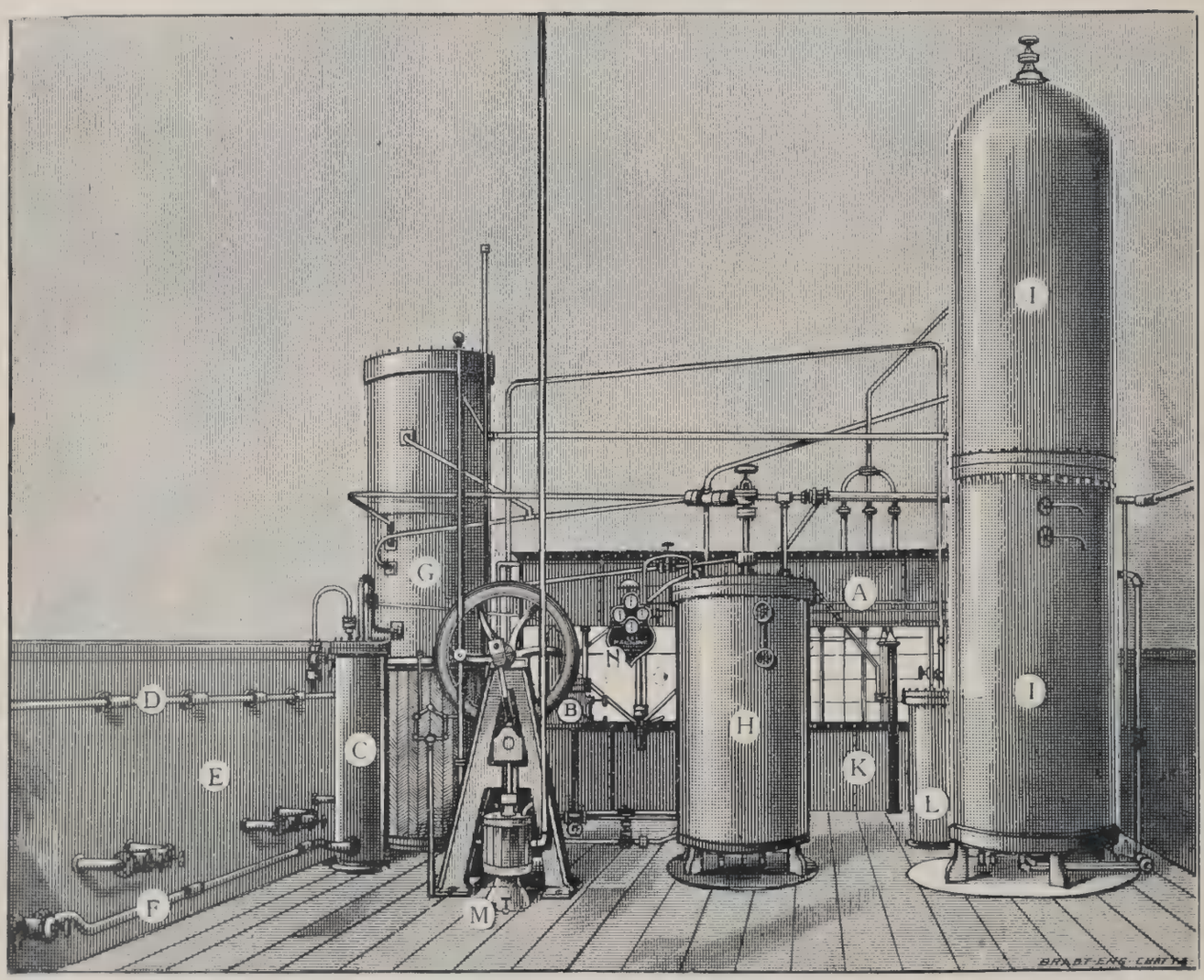
1000-HORSE POWER "EGLIPSE" PLAIN CORLISS ENGINE.

SOUTHERN ICE MACHINE CO.

SOLE OWNERS AND MANUFACTURERS OF

. . . The Latest Improved Absorption . . .

ICE AND REFRIGERATING MACHINE.



∴ THE SOUTHERN ∴

The SOUTHERN ICE AND REFRIGERATING MACHINE is one of the best and has been acknowledged by the most experienced ice manufacturers to work more economical and produce ice cheaper and of a better quality than any other machine on the market to-day

ALL MACHINES NOW IN OPERATION ARE GIVING PERFECT SATISFACTION.

FOR ESTIMATES AND FURTHER PARTICULARS ADDRESS THE

SOUTHERN ICE MACHINE CO.

CHATTANOOGA, TENN.

HERCULES

Ice and Refrigerating

MACHINE

(REFRIGERANT: ANHYDROUS AMMONIA.)

FOR

BREWERIES, PACKING HOUSES, COLD STORAGE.

. . . Artificial Ice Plants . . .

DRIVEN BY INDEPENDENT CORLISS ENGINE, WHICH CAN BE USED TO OPERATE OTHER MACHINERY.

Strongest, Most Durable and Most Economical Machine

ON THE MARKET

Our Guarantee is the Highest given by any Company, and Every Machine Sold has Exceeded the Guarantee.

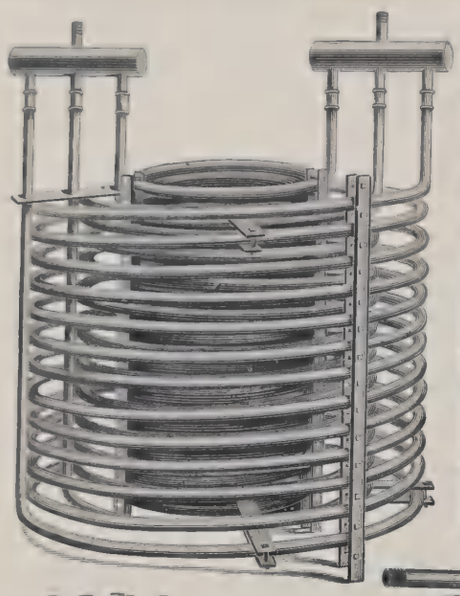
SEND FOR ILLUSTRATED CIRCULAR AND REFERENCES.

THE HERCULES IRON WORKS,

ROOM 502 OWINGS BUILDING,
DEARBORN AND ADAMS STS.

CHICAGO . .

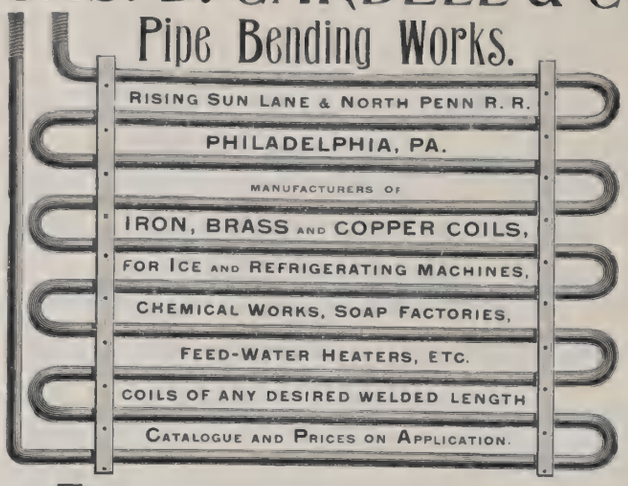
WORKS, AURORA, ILL.



JAMES D. CARDELL. WASHINGTON HOPKINS.

JAS. D. CARDELL & CO.

Pipe Bending Works.



RISING SUN LANE & NORTH PENN R. R.

PHILADELPHIA, PA.

MANUFACTURERS OF

IRON, BRASS AND COPPER COILS,

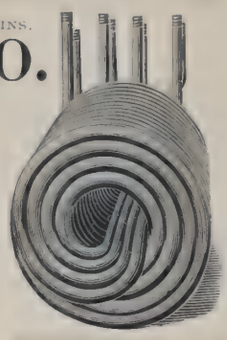
FOR ICE AND REFRIGERATING MACHINES,

CHEMICAL WORKS, SOAP FACTORIES,

FEED-WATER HEATERS, ETC.

COILS OF ANY DESIRED WELDED LENGTH

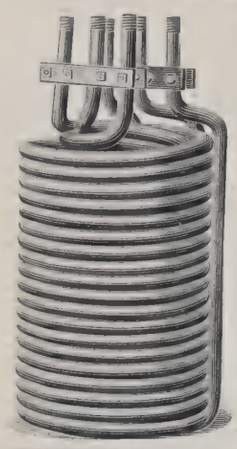
CATALOGUE AND PRICES ON APPLICATION.



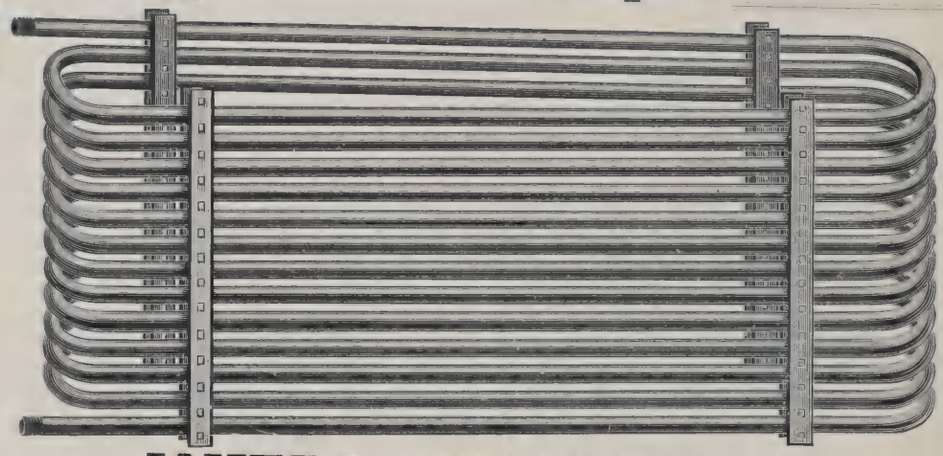
BENDING @

Of Large Sizes Pipe a specialty

SEND FOR CATALOGUE.



Brine and Condenser Tanks, Ammonia Bottles, Ammonia Valves, Flanges, ETC.

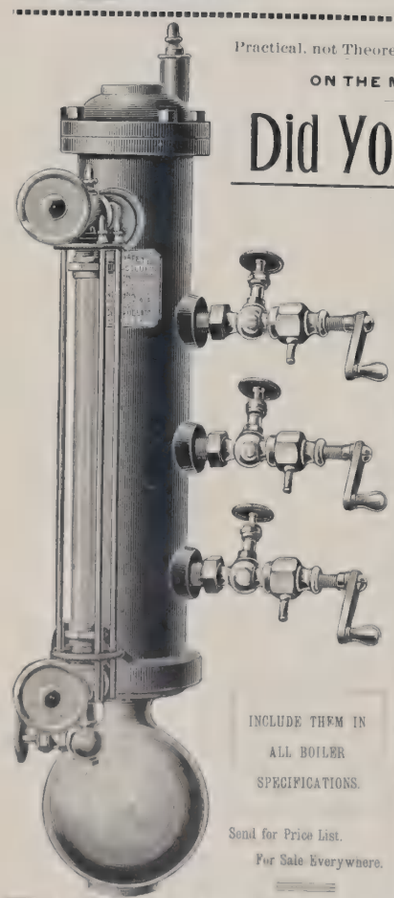


JAMES D. CARDELL & CO.

Practical, not Theoretical . . Over 15,000 in daily use.

ON THE MARKET SINCE 1884.

Did You Ever Stop



to think what it means to have the water carried uniformly at the proper level?

IT MEANS safety, saving of fuel, steady power, and more of it, no leaky tubes, no burned boilers, no stoppage for expensive repairs.

ALL of which

YOU CAN secure for merely nominal cost,

BY USING

INCLUDE THEM IN ALL BOILER SPECIFICATIONS.

Send for Price List.

For Sale Everywhere.

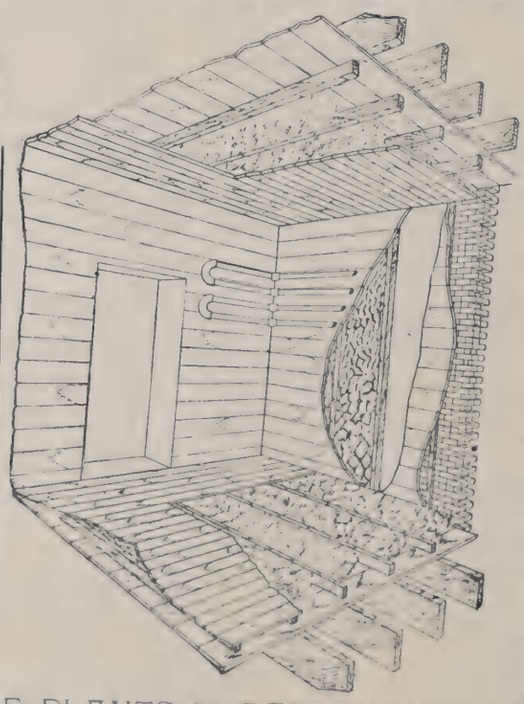
The Reliance Safety Water Columns.

THE RELIANCE GAUGE CO.

101 EUCLID AVE., CLEVELAND, O.

MINERAL WOOL

COLD STORAGE, BREWERIES



INSULATION

ICE PLANTS REFRIGERATORS

FOR FREE SAMPLE AND BOOK, ADDRESS

Western Mineral Wool Co.

CHICAGO. CLEVELAND. ST. LOUIS.

Write for Prices on the . . . . . .

CORRUGATED... ... WATER-TUBE **FEED-WATER HEATER**

More Effective and Durable . . . . . .

Than a Coil Heater at the Same Price.

SOLE MANUFACTURERS:

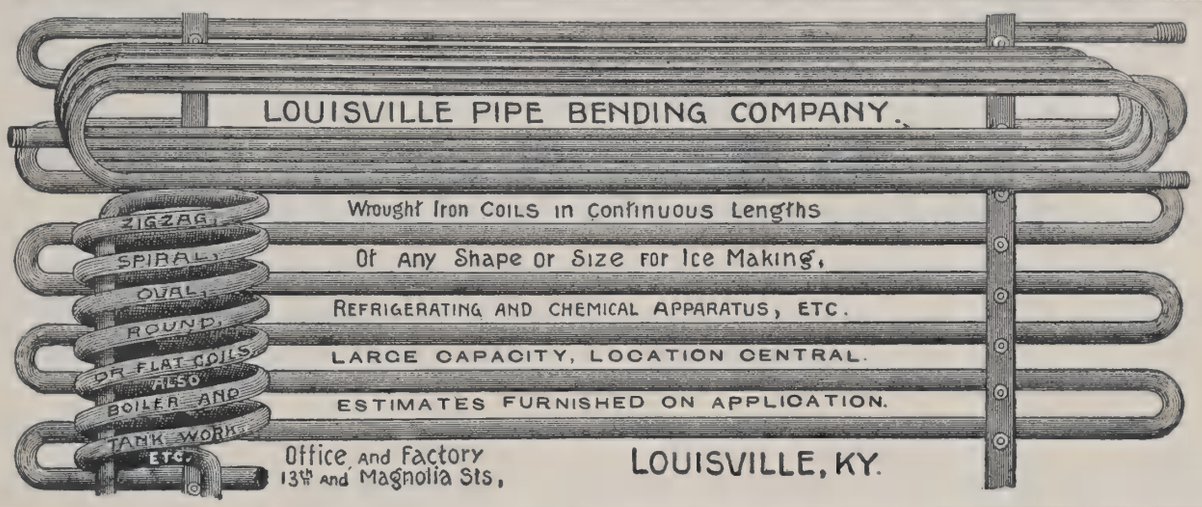
The Wainwright Manufacturing Co. of Mass.

8 Oliver Street, BOSTON.

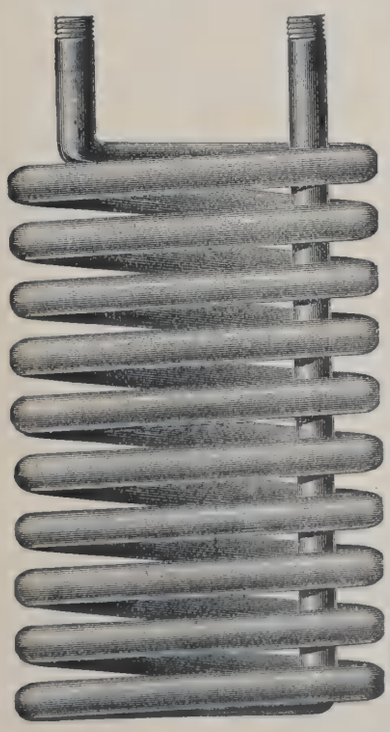
SEND FOR CATALOGUE I. C.

CHICAGO: 26 West Randolph Street.

NEW YORK: 121 Liberty Street.



THE HARRISBURG PIPE BENDING CO. LIMITED



WORKS, S. E. CORNER HERR STREET AND PENNSYLVANIA CANAL. HARRISBURG, PA.

.....MANUFACTURERS OF.....

COILS AND BENDS

Of Wrought Iron Pipe . . For Ice Making and Refrigerating

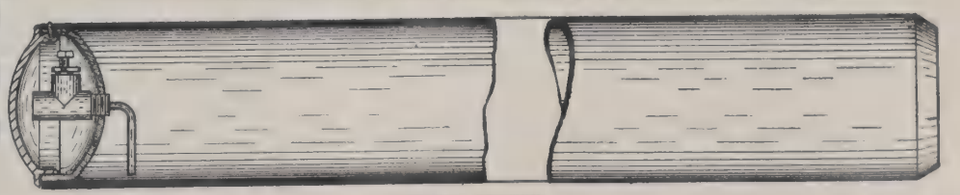
in Round, Oval, Zigzag, Spiral, Helical and Tapering Forms.

CHEMICAL WORKS, FEED-WATER HEATERS,

BLAST FURNACES, EVAPORATING LIQUIDS,

AMMONIA MACHINES, SOAP WORKS, ETC.

IRREGULAR PIPE BENDING A SPECIALTY



AMMONIA BOTTLE.

AMMONIA . BOTTLES . OR . FLASKS . WITH . WELDED . HEADS

STRAIGHT OR CONCAVE

New York Coal Tar Chemical Co.

10 WARREN ST., NEW YORK.

MANUFACTURERS OF

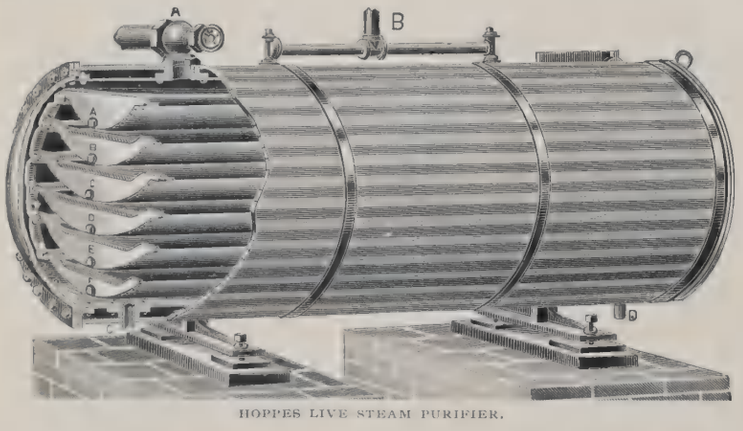
ABSOLUTELY PURE

ANHYDROUS AMMONIA

AND

AQUA AMMONIA

FOR REFRIGERATING PURPOSES.



HOPPES LIVE STEAM PURIFIER.

THE

"HOPPES"

Live Steam Feed-Water

PURIFIER

Is especially adapted to ICE MAKING PLANTS, as pure water is essential to insure a good quality of ICE. The use of the HOPPES PURIFIER will insure you pure water, by removing all of the impurities therefrom, at the same time keeping your boilers clean and free from scale without the use of boiler compounds or scale solvents.

CATALOGUES, ESTIMATES, SPECIFICATIONS, ETC., CHEERFULLY FURNISHED.

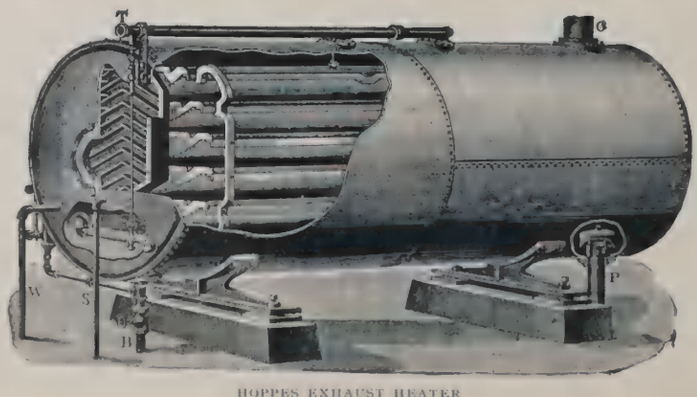
THE HOPPES MFG. CO., SPRINGFIELD, O.

IF YOU WANT TO GET THE FULL BENEFIT OF YOUR EXHAUST STEAM, INVESTIGATE THE

"HOPPES"

Exhaust Steam Feed-Water

HEATER



HOPPES EXHAUST HEATER

The National Ammonia Co.

... ABSOLUTELY DRY AND PURE ...

LIQUID ANHYDROUS AMMONIA AND AQUA AMMONIA (ALL STRENGTHS),

For Refrigerating and Ice Machines.

GENERAL OFFICES:--ST. LOUIS, MO.

Our Ammonias are the Recognized Standards of Quality. Use Our Brands and Secure the Best Results with your Machines.

We are the Largest Manufacturers in the World. Send your Orders to Us and Get Prompt and Satisfactory Service.

Our Ammonia can be had of the following Agents:

NEW YORK—The De La Vergne Refrig. M. Co.
W. M. Schwenker.
Mallinckrodt Chemical Works.
PHILADELPHIA—Theo. J. Goldschmid.
BALTIMORE—Wm. Mitchell.
WILMINGTON—Delaware Chemical Co.
BUFFALO—Kast Copper & Sheet Iron Co.
ST. LOUIS—Mallinckrodt Chemical Works.
Larkin & Scheffer.
CINCINNATI—Herman Goepper & Co.
CLEVELAND—Benton, Myers & Co.
DETROIT—Michigan Ammonia Works.
KANSAS CITY—Henry Menderson.
CHICAGO—A. Magnus' Sons.
Fuller & Fuller Company.
MILWAUKEE—The Chas. Baumbach Company.
SAN FRANCISCO—Herrmann & Company.
PORTLAND, ORE.—Snell, Heitschu & Woodard.

B. P. CLAPP AMMONIA COMPANY,

MANUFACTURERS OF

ABSOLUTELY PURE - - 26° AQUA AMMONIA

Containing 29¼ per cent of Ammonia. FOR REFRIGERATING PURPOSES AND THE TRADE . . . . . .

GENERAL OFFICES:

245 BROADWAY, NEW YORK.

THE CLEVELAND ANHYDROUS AMMONIA WORKS

THOS. FLESHER, JR., Proprietor.

MANUFACTURERS OF ...PURE... Anhydrous Ammonia.

70 E. Prospect St., CLEVELAND, OHIO.



GEO. WOOLFORD,

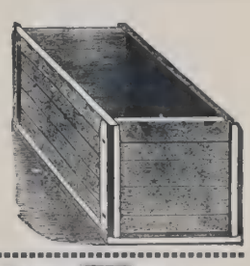
Manufacturer of all kinds of

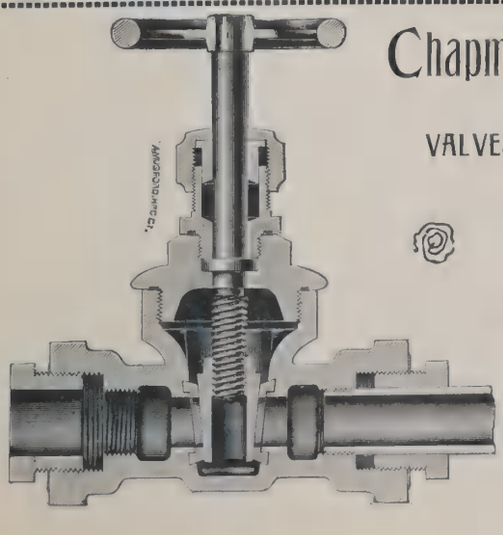
Cedar Vats, Tanks, HOT AND COLD Water Tanks, Railroad Tanks

In sending for estimates, state if measurements are inside or outside, and thickness of wood desired . . . . . .

FOR ICE FACTORIES, COLD STORAGE HOUSES RAILROADS, PACKERS, CHEMICAL WORKS, ETC.

2240, 2242 and 2244 North 9th Street, PHILADELPHIA.





Chapman Valve Manufacturing Co.

.....MANUFACTURERS OF.....

VALVES AND GATES FOR WATER, GAS, STEAM, ACID, OIL, AMMONIA, ETC.

ALSO GATE FIRE HYDRANTS

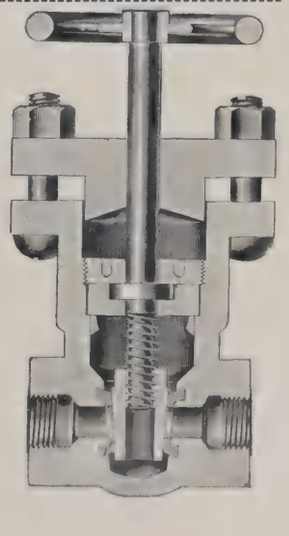
SPECIAL ATTENTION GIVEN TO

VALVES FOR REFRIGERATING, COLD STORAGE, ICE MAKING MACHINERY, ETC.

We make the best Valve for Ammonia Heavy Pressure in the market. The two illustrations here represent Ammonia Valves that are giving universal satisfaction.

General Office and Works, INDIAN ORCHARD, MASS.

Treasurer's Office, 72 Kilby and 112 Milk Sts. BOSTON, MASS.



THE LAIDLAW & DUNN CO.

PURCHASERS OF { McGOWAN PUMP CO. / ECLIPSE PUMP MFG. CO.

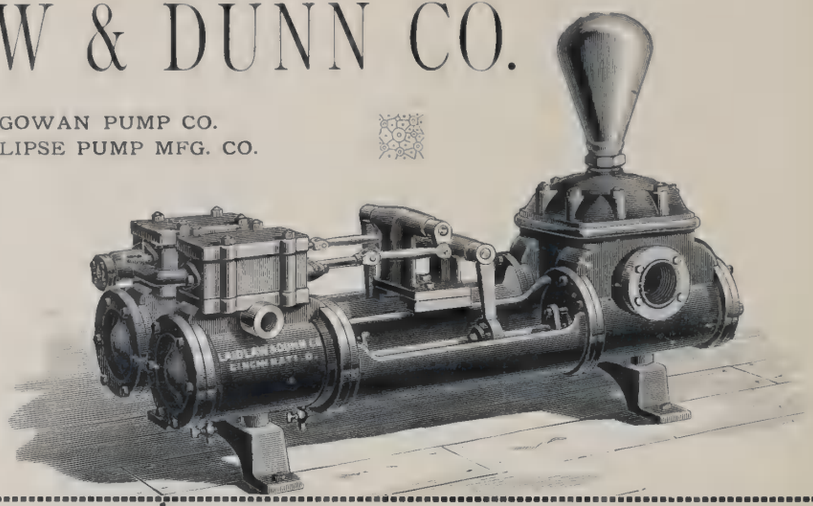
MANUFACTURERS OF

BRINE
WATER
BREWERY

PUMPS

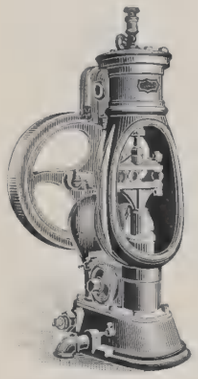
AND PUMPS FOR ALL PURPOSES.

CINCINNATI, OHIO.



AMMONIAL LIQUID . . . .

PUMPS



FOR USE IN.....

ICE MAKING AND REFRIGERATING PLANTS

These Pumps are made very heavy and guaranteed to work smoothly against 300 pounds pressure to the square inch . . . . . .

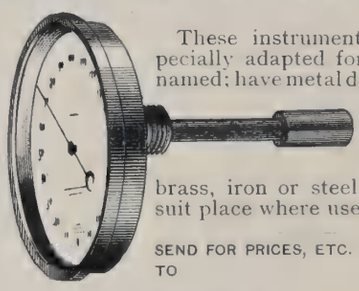
VALLEY PUMP CO.

EASTHAMPTON, MASS.

Standard Thermometers.

FOR USE IN

Ice Machines,
Refrigerators,
Brine Tanks,
Ammonia
Circulating Pipes,
Etc., Etc



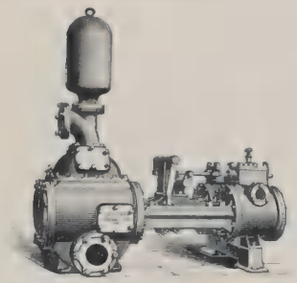
These instruments are especially adapted for purposes named; have metal dials, either brass, iron or steel casing to suit place where used.

SEND FOR PRICES, ETC. TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Cortlandt St. Boston Office, 70 Pearl St.



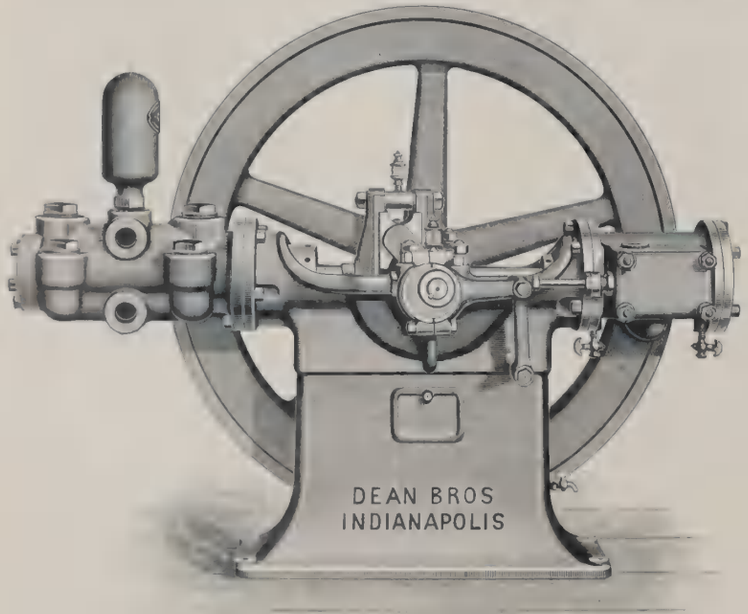
DUPLEX WATER SUPPLY PUMP.

DEAN BROS.

· Steam Pump Works ·

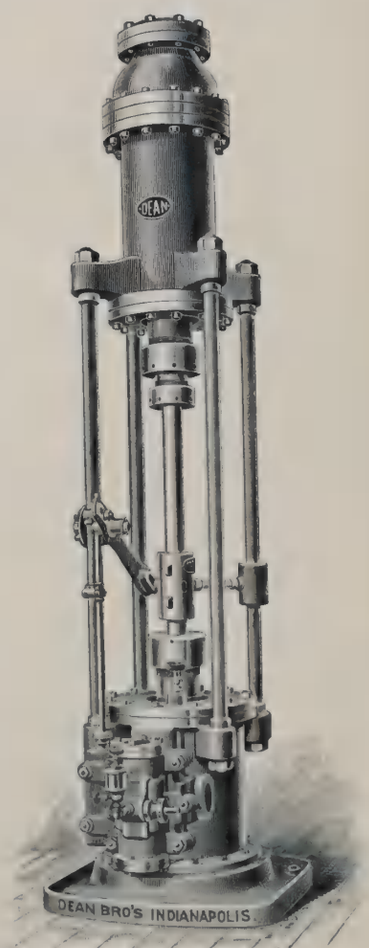
INDIANAPOLIS, IND.

BOILER FEEDERS, BRINE PUMPS,
DEEP WELL PUMPS, SINGLE AND DUPLEX PUMPS.



HORIZONTAL AMMONIA PUMP.

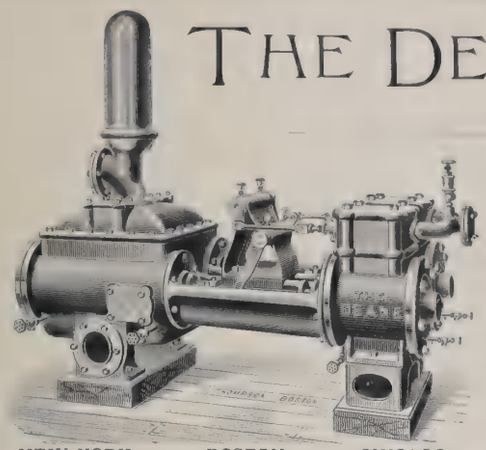
SEND FOR CATALOGUE



VERTICAL AMMONIA PUMP

THE DEANE STEAM PUMP CO.

HOLYOKE, MASS.



STEAM PUMPS

FOR EVERY SERVICE.

AMMONIA PUMPS,
BRINE PUMPS,
TANK PUMPS, ETC.

For Ice Manufacturing Machinery

For full information and Illustrated Catalogue, write . . . . . .

NEW YORK. BOSTON. CHICAGO.
PHILADELPHIA. ST. LOUIS. DENVER.

DEANE STEAM PUMP CO., Holyoke, Mass.

A. D. COOK

.....MANUFACTURER OF IMPROVED.....



Tube Well Supplies

Cook's Patent Tube Well Strainers

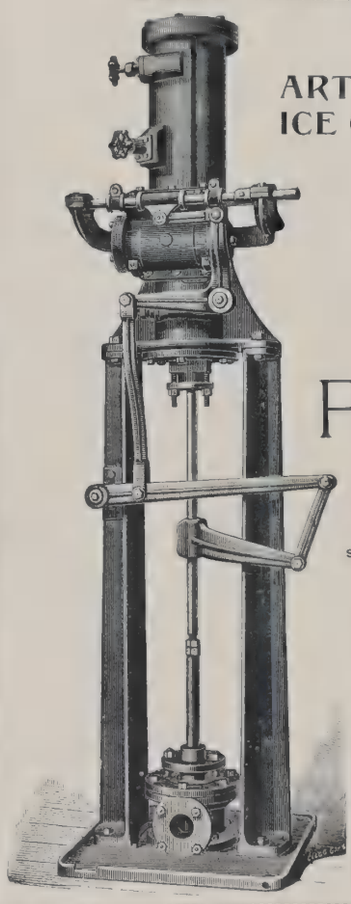
.....AND.....

STEAM PUMPS ...A... SPECIALTY

LAWRENCEBURG, IND.

EPPING Pump

. . . DEEP-WELL



.....FOR.....

ARTIFICIAL ICE COMPANIES

BREWERIES
COLD STORAGE
WAREHOUSES

PUMPS

For all Purposes.

SEND FOR CATALOGUE TO

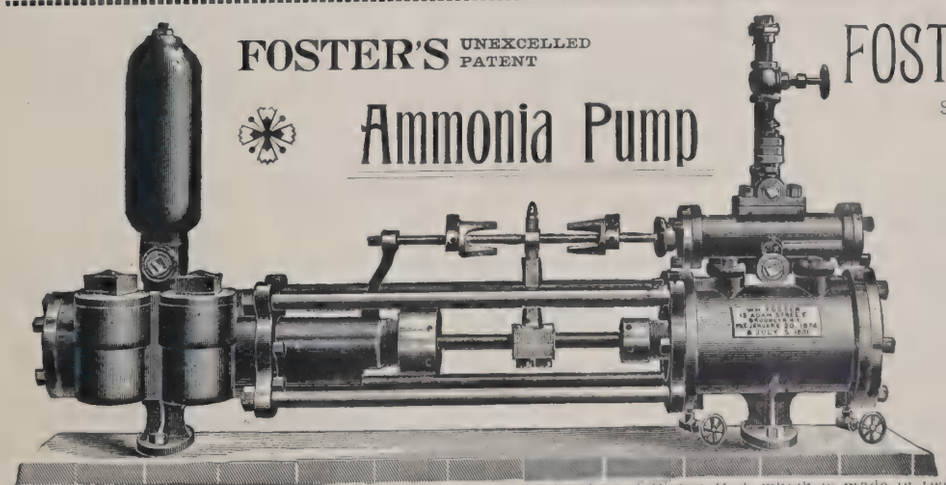
EPPING, CARPENTER & CO. LIMITED,

2410-2420 Penn Ave.,

PITTSBURGH, PA.

FOSTER'S UNEXCELLED PATENT

Ammonia Pump



ing-box is carried back into the suction again. It has extra hard steel Piston Rod, which is made in two sections, so as to be easily replaced when ammonia part of piston rod is worn out, and without necessitating the removal of the steam portion of rod.

FOSTER PUMP WORKS

Successors to WILLIAM FOSTER

MANUFACTURERS OF

PATENT IMPROVED

STEAM PUMPS

FOSTER'S EXCELSIOR ROTARY PUMPS.

Beer and Mash, Boiler Feed, Tank, Air, Deep Well and Artesian Well Pumps.

36 AND 38 BRIDGE ST. **BROOKLYN, N.Y.**

The advantages of this Pump are, its extra long double stuffing-box, which is so arranged that any leakage from first stuffing-box is carried back into the suction again. It has extra hard steel Piston Rod, which is made in two sections, so as to be easily replaced when ammonia part of piston rod is worn out, and without necessitating the removal of the steam portion of rod.

HERF & FRERICHS CHEMICAL CO.

ST. LOUIS, MO.

MANUFACTURERS OF

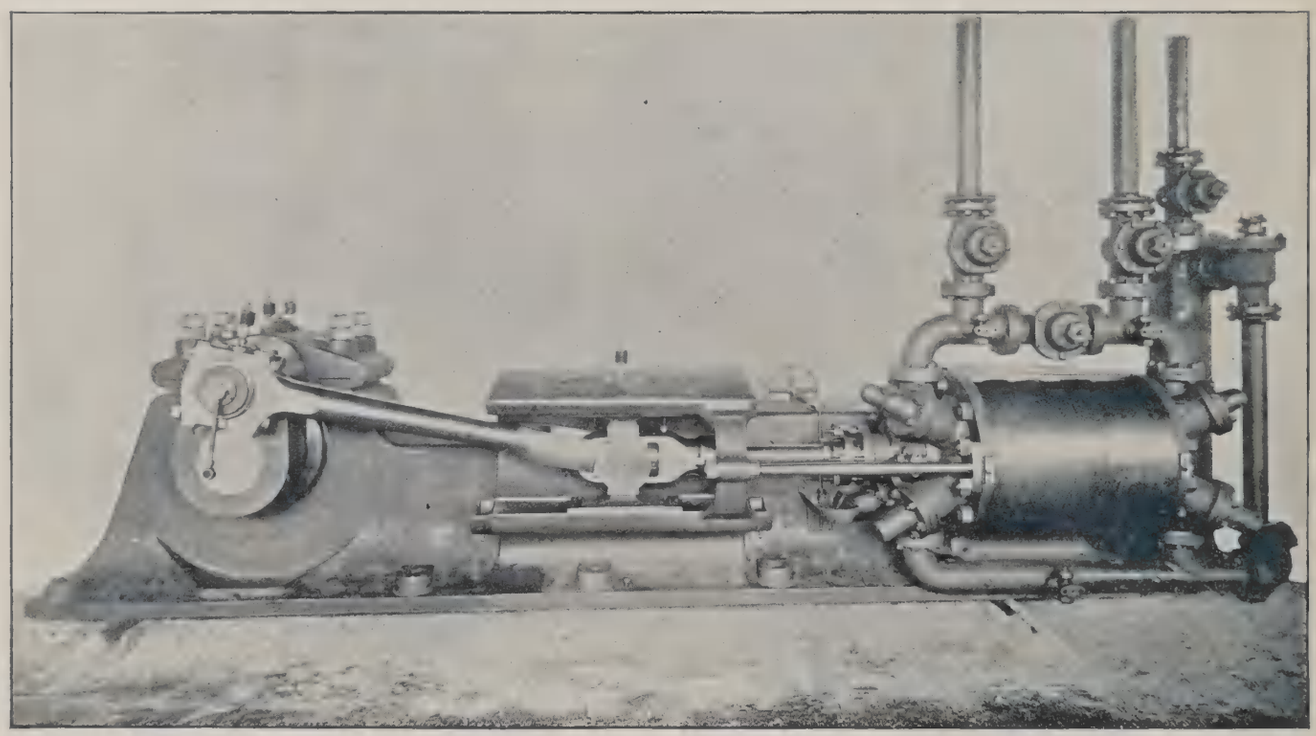
Liquid Anhydrous Ammonia

ABSOLUTELY DRY, PURE AND UNIFORM ALL THE YEAR ROUND . . . . .

26° Ammonia

SPECIALLY PURIFIED FOR ABSORPTION MACHINES . . . .

All our Ammonia is made from Sulphate Ammonia only. Large capacity, best qualities and quick shipments.



No. 8 LINDE COMPRESSOR

100 TONS CAPACITY.

MANUFACTURED BY

THE FRED. W. WOLF CO.

560 North Halsted Street, CHICAGO, ILL., U. S. A.

FOR ICE FACTORIES, COLD STORAGE HOUSES, BREWERIES AND PACKING HOUSES . . . . .

CORRESPONDENCE SOLICITED. .

OVER 1300 MACHINES IN ACTUAL OPERATION.

ICE AND REFRIGERATION

ILLUSTRATED

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. I. NO. 2. CHICAGO : NEW YORK : AUGUST : 1891. $2.00 PER ANNUM.

TEXAS ICE MANUFACTURERS ASS'N.

NATURAL PREJUDICE AGAINST ASSOCIATIONS—ORIGINATORS OF THE TEXAS ASSOCIATION—ITS OBJECT, SUCCESS AND FUTURE BENEFICIAL RESULTS.

To heap harsh criticism upon associate organizations of all character indiscriminately, seems the object and aim of many individuals who seek to either gain notoriety by inflaming the ready imagination of a sensitive and suspecting public, or to preach upon a possible plank of their own aspiring platform. The exposure and final dissolution of harmful combinations is not at all too frequent, as the national tendency of manufacturers to unite to control output and price is increasing to such an alarming degree that a positive check is demanded. Therefore, the public can hardly be blamed for the suspicion that is immediately excited upon learning of any "clannish" relations existing among a number of similar enterprises.



C. W. DAWLEY, PRESIDENT, DENISON, TEX.

The fact of there being different classes of associations is often, however, entirely lost sight of or intentionally ignored. The inconsistency of such a stubborn position is, as a matter of course, appreciated more by those interested than by outsiders, who have either never experienced the benefits derived from industrial association, or are too prejudiced to discriminate between legitimate and illegitimate associations. Those of a more reasonable and generous mind are not numbered among the class who do discriminate.

The original idea of organizing a mutual association by the ice makers in Texas can be credited to Mr. R. E. Maddox, of Fort Worth, and Mr. C. W. Dawley, of Denison. These two gentlemen, after consulting together, early in 1888, opened correspondence with every manufacturer they could reach in the state, urging the need of such a movement. Later circulars were forwarded, and a meeting set for March 2, 1890. This first definite effort to bring together the Texas ice manufacturers into convention met with hearty response. Letters of congratulation and good feeling toward the enterprise, and proxies to the meeting poured in from all quarters of the state. When the day arrived all parts of Texas were represented, including its two extreme points. The meeting was called to order, and the following officers elected: R. E. Maddox, president, Fort Worth; C. W. Dawley, vice-president, Denison; F. M. Polhamius, secretary, Texarkana. The two days' time was consumed in discussions and the delivery of addresses on various subjects, when the meeting adjourned to reassemble March 20. At the second meeting many new names were enrolled, when the title of "The Texas Ice Manufacturers Association" was adopted, together with the following preamble:

"The object of this association shall be to present, discuss and act upon such matters as pertain to the mutual benefit of the ice manufacturers of the state of Texas: to better systematize the service to the public, to advance our legitimate interests, and to promote the industry in which we are engaged."

So flattering were the prospects after this second meeting that the association was pronounced by all a success.

First in the line of improved facilities was the satisfactory basis of freight rates placed on car load traffic by every line in the state. Much credit is due the

various railway companies for the prompt and progressive spirit manifested in assisting home industry.

Last fall the association began arrangements to erect their own ammonia plant, after the severe lesson suffered from the shortage and inability of the regular companies to fill the demand of the season of 1890, and to secure a pure and unlimited supply for their own use. Ample assurance of assistance was at hand, but the execution of the plans was held open, pending action of the annual meeting to be held in March, 1891, when it was found that the contracts offered by the old companies were satisfactory, and the project was indefinitely postponed.

The opportunity to obtain official representation through a periodical publication, came too late to bring before the regular annual meeting, but was gladly accepted when ICE AND REFRIGERATION was duly authorized to represent the association in all matters.



F. M. POLHAMIUS, SECRETARY AND TREASURER, TEXARKANA, TEX.

And so the organization has progressed, meeting annually and exchanging views and experiences, until they feel the improvement over their former feeble condition, and the association is proud to number among its members nearly all the reputable factories in the state, while those who have so far failed to become members have appreciated the advantages already enjoyed. There can be no question of the results. Methods of management are becoming more systematic; questions of regulation are uniform under similar conditions with those elsewhere, while a general pride is shown throughout the business that was not before exhibited: and most assuredly the public have very largely been the gainers.

In the near future, the opportunity will be afforded the several associations, all over the United States, to meet in convention; and the Texas manufacturers look forward to this event as one of great interest, insuring a higher order of debate, and opening a wider range of new ideas.

C. W. DAWLEY, PRESIDENT TEXAS ICE MANUFACTURERS ASSOCIATION.

Mr. C. W. Dawley, president of the Texas Ice Manufacturers Association, began business in Fort Smith, Ark., erecting the city gas plant, under a charter granted in 1883. Leaving Arkansas, he located in Denison, Tex., in 1885, that city offering the best opportunity for an ice plant. The Denison Crystal Ice Co. was established by Mr. Dawley and Mr. R. Myrick, of Fort Smith, when a consolidated machine was built, in 1886.

The demands of his section have so increased that the capacity of his plant has been enlarged by the addition of a 25-ton Hercules.

Mr. Dawley's ability and judgment have always been noticeable. From the beginning he became a prominent factor in ice circles. In 1890 he organized the Dallas Ice Factory and Cold Storage Co., Dallas, Tex., of which he is president, with a capital stock of $300,000, increasing the capacity, and making other valuable extensions and improvements. This plant is now among the largest and finest equipped plants in the country, operating a daily capacity of nearly 200 tons. This company also absorbed the East Dallas water works system, and thereby secured an abundant supply of water.

Mr. Dawley is recognized as a thorough leader. Energetic and progressive, he has, through his own exertion, brought himself to the front rank, where he is regarded as one of the best informed men in the business.

In addition to his Dallas interests, he is secretary and manager of the Crystal Ice Co., of Denison, interested in the Sherman Ice Co., one of the most complete plants in the state, and has recently purchased the plant at Paris, Tex., which will be remodeled and improved in all requirements.

One of the originators of the Texas Ice Manufacturers' Association, and a prime mover in all of its undertakings, he was elected its president, at the annual meeting, in March last.

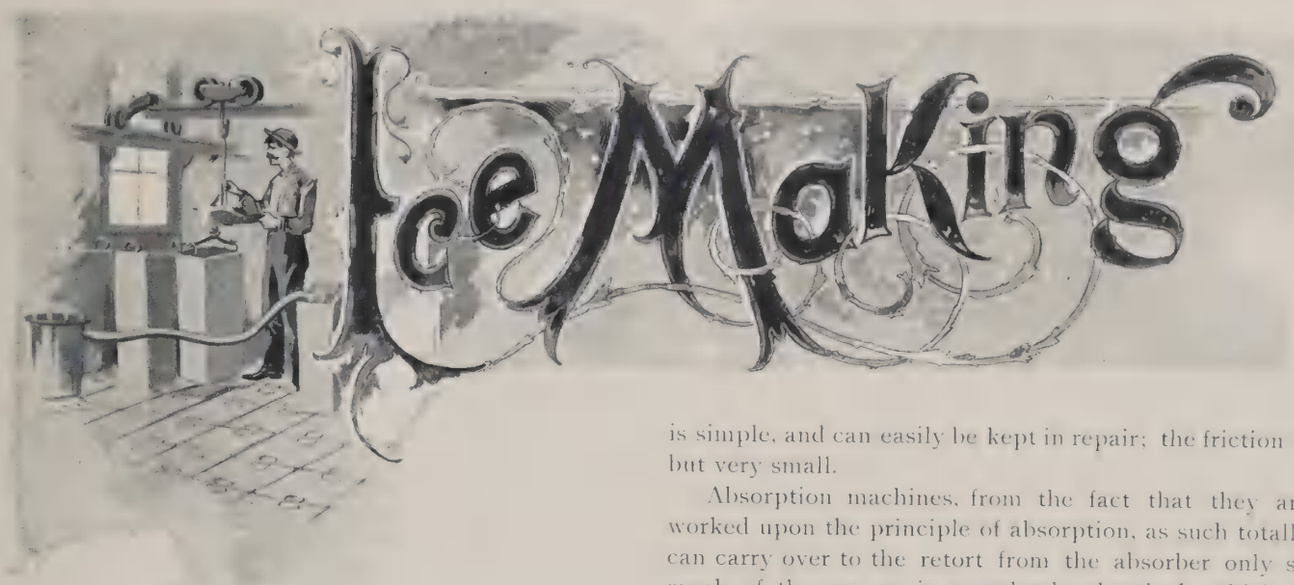
F. M. POLHAMIUS, SECRETARY AND TREASURER TEXAS ICE MANUFACTURERS ASS'N.

Mr. F. M. Polhamius, secretary and treasurer of the Texas Ice Manufacturers Association, was born in New York city, in 1865. Moving south in 1879, was employed in the wholesale grocery business in Hot Springs, Ark.

His father erected and operated the first successful machine in that city, in 1880, when the experience of his son in the ice business began. From a 5-ton, the Hot Springs machine was enlarged two years later to a 15-ton, which, at that time, was considered surplus capacity for the promising, though then little known, watering place. In 1886, the Texarkana plant was erected, where his operations in the ice business have since been confined.

Mr. Polhamius was instrumental in formulating the Texas Ice Manufacturers' Association, holding the office of secretary and treasurer since its organization.

——J. C. Bayley has purchased the Southworth ice business at Battle Creek, Mich., and leased the ice cutting privilege at the Spring Lakes for a long term of years.



[*Written for* ICE AND REFRIGERATION.]

ICE MAKING.

THE SUBJECT OF ICE MAKING TREATED BY A PRACTICAL MAN—COST OF PRODUCING ICE—IMPORTANT FACTS AND STATISTICS.

By Charles W. Biese.

[*Continued from July Issue, page 18.*]

ABSORPTION OR PHYSICAL MACHINE.

The absorption system is called so in consequence of the terminal operation. The aqueous solution of ammonia (aqua ammonia) is heated in a retort, until the ammonia is driven off in the form of a gas mixed with aqueous vapor (steam), the proportions being about ninety per cent of ammonia gas and ten per cent of aqueous vapor; the resulting vapor is then carried through the three operations of the cycle already described in the compression machine.

1. The compression of the gas is not by mechanical power, as in a compression machine, but results from the pressure by its distillation.

2. It is cooled and liquefied in coils of pipes surrounded by cold water.

3. It is allowed to re-expand to a gaseous state in coils surrounded by the substance to be cooled, in the same manner as described in the other system. The resulting gas having done its work of refrigeration, is then led from these coils through pipes to other coils of pipes to the absorber; in this absorber this gas is brought in contact with the water (or poor liquor) from which it was expelled by heating, said water or poor liquor having in the meantime been forced out of the retort through coils of pipe over which cold water is constantly running. From these coils of pipe it passes on to the absorber, over which water is also running. The water (mother liquid or poor liquor) having thus been cooled rapidly, absorbs the gas, and forms again a strong solution of ammonia. This solution being returned to the boiler by means of a pump, again enables the gas to go through the same style of operation.

THE MACHINERY.

The machinery required to perform these operations is simple, and can easily be kept in repair; the friction is but very small.

Absorption machines, from the fact that they are worked upon the principle of absorption, as such totally can carry over to the retort from the absorber only so much of the gas as is completely absorbed, which is the distinctive feature or principle of the machine, as now known and scientifically claimed.

In this is found by experience to be the greatest defect of absorption machines. For where the cooling water rises above 60 deg. F., as normal atmospheric temperature, occasioned by places and latitude, just in proportion of the rise of temperature the machine proves to be sluggish and inefficient in its results for both ice making and refrigerating.

Under the DeCoppet patented device of absorption in transit, where the machine was found to work sluggishly, the experiment was tried (in November, 1883) of introducing therein anhydrous ammonia. The result was found to be of immediate practical benefit in sharp work and increased output of the ice product. This beneficial effect was found to be continuous, viz.: That with it the water of absorption was made to take up and carry forward from the absorber through the pumps into the retort for distribution a greater degree or quantity of gas than could be properly attributed to the absorbent power or property of the water at its then temperature under all the known rules of percentage of absorption.

This fact thus ascertained was of essential value, as the limit of absorption machines for useful effect had been reached at 70 deg. F. or thereabouts, from thence proving ineffective in their operation for ice making, whereas the discovery of this new fact or process by which free ammonia gas could be carried over from the absorber to retort by the water as a vehicle thereof, and not as an absorbent, the water having already absorbed all it could, due to its temperature.

In the absorption of ammonia by water the amount of absorption is controlled by the temperature, hence when the temperature of the absorbing mediums is high, the density of the product will be low. This condition is one which has heretofore rendered absorption ice machines uncertain in their action and results.

This has been remedied to a certain extent by the application to the absorber of DeCoppet's transit process, by which large surfaces are exposed to cooling action, and absorption takes place from the time of the first conjunction of the gas with the absorbing medium until its delivery to the pump.

In addition to this it has been found that beside the gas taken up by absorption a large quantity of free gas can be carried along by mechanical conduction by so

arranging the mechanism that the inflowing gas can be developed by the liquor of absorption and carried along with it to the retort. By this means a much richer charge can be used, and a solution of 28 and 30 degs. Beaumé, instead of 26 deg. as heretofore. Other numerous small changes in the construction of ice machines have been invented and introduced, most of them proving of great benefit.

With this I will close my sketch of the history of the manufacture of ice and ice making machines, and devote the balance of the article to the cost of machinery necessary, and the erection of an ice machine, as well as the cost of manufacturing ice.

COST OF MACHINES.

In making an estimate of the cost of a complete ice making machine the following has to be taken into consideration:

First, the machine proper, cost at factory, freight from factory to place where the plant is to be erected, the erection of the machine.

Secondly, machinery for water supply.

Thirdly, building, foundations for machinery, etc.

It is safe to estimate that the cost of machines at factory is about $1,500 per ton capacity.

The cost of freight, labor and expense in erecting the machine, foundation for machinery, building, machinery for water supply and all other accidental and incidental expenses, can be estimated at $1,000 per ton capacity, hence a ten-ton machine would cost about $25,000, outside of the real estate upon which the plant is to be erected.

This does not include storerooms or houses, stables, wagons and all other necessary appendages to run an ice business successfully.

COST OF MANUFACTURE.

In giving any intelligent information on this subject, it has to be stated that only a general estimate of cost can be made, as each locality and condition may change very materially the cost of making ice. Take for an example that the plant is to be put near a watercourse, spring or well, and where the water will not be higher in temperature than 60 degrees the year round; or in another case the cooling water runs up to 90 deg. F., this will materially change the cost.

Then again, the water at 60 deg. F. may be so accessible that the pump which has to force the water to the mouth of the ice machine has but very little work to do, whereas the water at 90 deg. F. may be so far distant that it takes a great deal of power to force it to the place where wanted, or *vice versa*. In another case the plant may have to depend for the water supply upon the water works of a city, and be at their mercy as to price, hence to make a calculation as to the cost of water would be hardly possible, and has to be left to those who want to purchase a machine and make their arrangements accordingly.

The water supply is of the utmost importance, not so much as to its purity, as most of the ice making plants make the ice out of distilled and filtered water, but in regard to its purity or impurity would have only influence or effect on the steam boiler that can be remedied by boiler cleaners and other apparatus, all of which, of course, have influence upon the cost of making ice. The temperature of water, and the amount of water come-atable at a low or high price is a matter of serious consideration, and should be well and thoroughly investigated before any one engages in the ice making industry.

Too many blunders have been committed by the ill advice of those who sell ice making machines. And it is well to call the attention of those who aim to engage in this enterprise before it is too late. Next is the

COAL

supply. Of course one has to consider how much each different kind of ice machine may actually need. If you take the estimate that the manufacturers of ice making machines place upon the wants of their respective machines, it is put very low. The parties who have practical experience will soon discover the nature of the claims of those who are anxious to sell their machinery, for practical experience will soon teach the purchaser of an ice machine that these calculations are illusions, and that the cost of fuel is always more than calculated to be by the one who sells the ice making machine. Again, this will depend upon the cost of coal and upon the machine purchased.

COST OF LABOR.

This matter is readily calculated. An ice machine needs two engineers, two firemen, and for each tank two ice pullers. The wages of an engineer vary from $2.50 to $3; firemen from $1.20 to $1.50; ice pullers from $1 to $1.25. The amount of labor employed has to be calculated according to capacity of ice making plant.

Supply of ammonia and its waste is a question of importance, and should be well considered by any one who purchases an ice making plant or refrigerating machine. Of late a good deal of aqua ammonia used in the absorption machines and anhydrous ammonia used in the compression machines, has been placed upon the market, which is impure, and gives the operator not alone a great deal of trouble, but actually hinders him from making the capacity of ice his machine is prepared to make, or refrigerate the space of the capacity of the machine. A worthless article of this nature is frequently placed upon the market, and an injury is done.

The wastage of ammonia is caused frequently by purging out the impurities contained in the ammonia, and at other times on account of leaky joints and carelessness of the operator. All these points have to be taken into consideration.

REPAIRS OF MACHINES.

This is also a matter to be taken into consideration. Some of the ice making or refrigerating machines are made out of light material, hence the repair bills during the year are very large; others, again, are of but little consequence.

Oil is a matter easy to calculate. For an absorption machine the cost would be but very little, whereas in a compression machine it may run up to four cents per ton of ice. However, this would be an extreme.

OTHER CONSIDERATIONS.

The above-mentioned different parts of expenditures belong to the ice making plant proper, but when parties intend operating a plant of this kind, other expenditures and conditions should be taken into consideration.

One of the most important is the condition the operator or company may be placed in; the relationship of capacity of the machine with the demand for the output.

For an example: The parties in the ice manufacture have a machine with the capacity of thirty tons per twenty-four hours. The demand for the ice per day in

January, February and March would not be more than an average of five tons per day; in April and May, eight tons per day; in June, July and August, forty tons per day; in September and October, about eight tons, and November and December, five tons per day. Now, let us make a calculation: The first three months, or ninety days, the average sale per day would amount to five tons, or 450 tons for that period; the capacity of the machine would produce 2,700 tons, hence there would be a surplus of 2,260 tons. The sales for the next two months, or sixty-one days, at an average of eight tons per day, would amount to 488 tons; capacity of the machine would produce 1,830 tons, a surplus of 1,342 tons.

Suppose the operator or owner of the plant concludes to store the surplus of ice; this would make an additional cost for handling the ice from the mouth of the machine to storeroom, also for sawdust or other material used in storing ice to keep it from melting, and for cooling rooms prepared at the cost of cooling the space into which this surplus of 3,592 tons had to be stored. Furthermore, the cost of taking the ice out of the storehouses, the meltage and breakage, the total of which would not be less than 200 per cent in addition to the cost of manufacture; hence if ice is made at $2 per ton it will cost $6 per ton for the first five months of the year.

The next three months the demand will reach an average of forty tons per day, a demand of ten tons over and above the capacity of the machine. In order to supply the demand the owner of the plant has either to store ice during the winter months or purchase ice at a higher price than he realizes; either of these plans is a loss to his business, except prices will justify him to do so.

The sales of the remaining two months at five tons per day would aggregate 793 tons, whereas the capacity of the machine would produce 3,660 tons; again a surplus of 2,867 tons. Summing up the total production of the year, allowing thirty days for repairs, would amount to 10,050 tons if the machine would make its capacity. On the other hand, the sales would amount to 4,490 tons.

Now, then, if the cost to manufacture the ice would not be more than $2 per ton, the total output would cost $20,100, and if only 4,490 tons are sold the cost of it will be about $4.48 per ton. I have made this calculation without counting any accidents or losses so frequently occurring to any manufacturer, and have based the output of the machine upon the full capacity of the machine; neither have I underrated the amount of sales, which in most cases will be less than stated.

Localities and conditions may change the cost of manufacturing the ice; the demand may also be more in unison with the output, hence these matters must be left to the careful and observant business man to make his own calculations.

I have not mentioned the handling or delivery of the ice, as this belongs strictly to the delivery department, and has nothing to do with the manufacture of ice. The cost of delivery is a matter of itself.

——A tramp stole a ride on a central Illinois road in an ice car, and was discovered at Champaign, by groaning in the car. The reporter says: "His half frozen body was soon released in a condition to show that in a few hours more he would have been frozen to death."

AVOID AMMONIA DRUM EXPLOSIONS.

The device shown in the accompanying sketches has been designed by Prof. Siebel, of Chicago, for the purpose of preventing explosions of ammonia drums. If drums are filled with anhydrous ammonia to the brim, or nearly so, the least expansion of ammonia, due to a small increase in temperature, may cause the cracking or bursting of a drum, which, owing to the suffocating

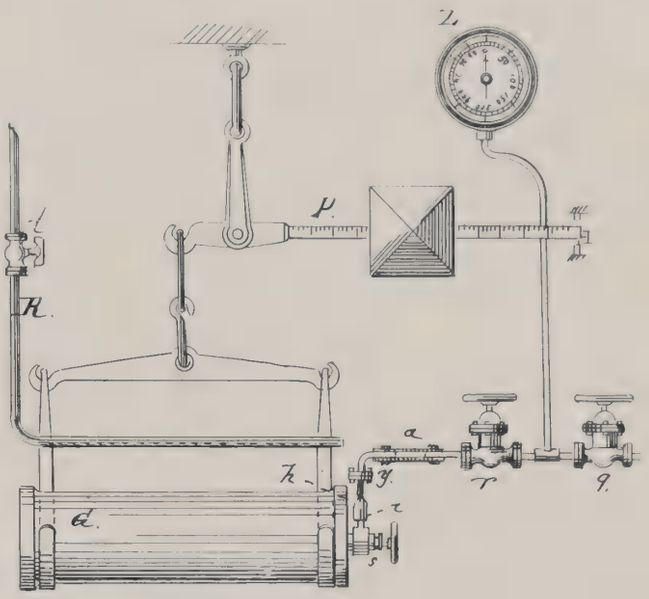


FIG. 1.

nature of the vapors, is a very dangerous occurrence. In order, therefore, to prevent an overfilling of the drum, every drum is gauged as to its capacity by weight, and while being filled is suspended, as shown in Fig. 1, by two hooks suspended at one end of a lever scale *p*. The weight is adjusted and the drum filled by opening the valves *r* and *s*. Meanwhile cold water is allowed to be sprinkled over the drum to reduce the pressure within as much as possible. As soon as the drum end of the

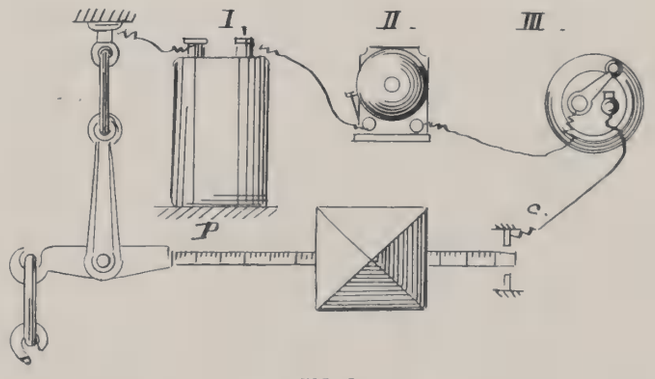
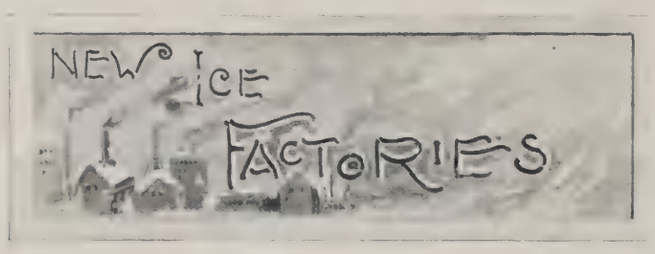


FIG. 2.

scale drops, the valves *r* and *s* are closed, and the drum replaced by another one. Fig. 2 shows a portion of the same device combined with an electric alarm, so that when sufficient liquid ammonia has been forced into the drum, and the scale beam tips, it readily strikes against the projection *c*, thereby closing the current between the beam *P*, the battery *I*, alarm *II*, and switch *III*, and consequently sounding the alarm.

——The Chester Ice Manufacturing Co., Chester, Pa., is in financial difficulties, and is in the hands of the sheriff.

——Carpenters at work on the new ice factory on West Broad street, Columbus, Ohio, struck July 16, because of the employment by the contractor of a non-union laborer.



The construction "season" is now about over for a few months, to begin again in the fall, running through the winter and spring following. The season past has been one of great activity, not alone through the South, but in the North as well, and a very large amount of capital has been permanently invested in ice manufacturing plants. It is certain that the future will see still greater activity in this direction. Machinery makers generally are having good inquiry from prospective buyers, who have already begun laying their plans for entering the field for next summer's trade. There is in this line, as in all others, a great deal of tentative inquiry that eventually amounts to nothing, though that is inevitable and common in all lines of machinery. We find, too, that a great many trade journal reports of "new factories projected" are purely imaginary, or based on this man's or that man's thoughtless or careless, "guess-I'll-go-into-it"; but, on the other hand, ICE AND REFRIGERATION, even this early in the construction season, finds that ice and refrigerating machinery is attracting no little attention among business men who have until of late never given it further than a passing thought. It is becoming an element in food preservation that promises soon to become of vast extent and importance. Cold storage is the coming feature of food conservation and distribution, and not many years hence will be recognized as one of the greatest blessings modern science has given to mankind.

Our record of new establishments is obviously less imposing this month, and will not be specially noteworthy for a few months to come, perhaps; but of the record this may be said, that it is accurate. Wherever there existed a doubt of the reliability of our information we have in all cases verified it by applying direct to the parties in interest. We have in this way necessarily abbreviated the list of new projects that might have been mentioned, but have at the same time more than doubled the reliability of the information conveyed in this department.

ARKANSAS.

Arkansas City—The organization of a stock company to erect an ice factory is talked of. J. W. Dickinson, Jr., can give information.

Titusville—The Atlantic Coast Ice, Fish & Canning Co. are to soon commence the erection of their ice factory.

CALIFORNIA.

Santa Barbara—The new ice factory will soon be in operation.

COLORADO.

Denver—The Colorado Ice & Cold Storage Co. will increase the capital stock from $250,000 to $525,000.

CONNECTICUT.

South Norwalk—Donavan & Co., wholesale liquor dealers, have just put in a small De La Vergne machine.

FLORIDA.

St. Augustine—The statement made last month that Mr. A. Springer, of St. Augustine, Fla., had removed his 12-ton plant to Fernandina, Fla., is an error. He is running a Columbus Iron Works machine in St. Augustine, and the same company are putting in a new machine for him at Fernandina.

GEORGIA.

Brunswick—A company will probably be organized to erect an ice factory. W. F. Symonds can give information.

ILLINOIS.

East St. Louis—W. J. Hodges, O. F. Stifel, E. Sells and Geo. W. Diekes, of St. Louis, have been making an inspection tour of ice factories in the South recently. They contemplate erecting a large ice factory and cold storage house at East St. Louis.

Mt. Vernon—J. T. Howard is looking for a good location for an ice factory.

INDIANA.

Lafayette—The Lafayette Artificial Ice Co.'s plant has begun operations; capacity, thirty-five tons daily; retailing for forty cents per hundredweight. A few sample blocks were frozen, containing respectively a roast of beef, a beefsteak, a black bass, a bouquet of flowers, bananas and oranges, which were distributed to customers dealing in the articles named. This company was organized in March last, with $50,000 capital stock, of which the plant consumed $30,000. They purchased a Blymyer machine.

KENTUCKY.

Danville—The Danville Ice Co. have begun work on a series of eight or ten artesian wells to supply the ice factory.

Danville—There has been talk of an ice factory, but not in a very hearty manner.

Louisville—The Northern Lake Ice Co. will add new buildings to their plant, to cost $85,000.

Newport—The Newport Ice Co. has completed the plant, and is now making ice.

Winchester—A new company will build an ice factory.

LOUISIANA.

Baton Rouge—The Louisiana Artificial Ice & Cold Storage Co. started up a 15-ton De La Vergne machine August 1.

Jonesville—The Southern Ice & Cold Storage Co., of Chattanooga, Tenn., will erect an ice plant and cotton seed oil mill at this place; capital $25,000.

New Orleans—R. T. McDonald & Judah Hart's 50-ton factory started up August 1. They use a Blymyer machine, the first charge having been furnished by the National Ammonia Co.

MISSOURI.

St. Louis—The new ice factory of the Carondelet Electric Lighting Co. began making ice July 14.

NORTH CAROLINA.

New Berne—The New Berne Ice Co. have begun making ice, using a York machine, and artesian water; capacity about eight tons a day. They have also a cold storage room attached to the factory. The investment is $15,000.

OHIO.

Columbus—Mr. Dennis J. Kelly is president of a new ice factory company now erecting an extensive plant. They are making about fifty-five tons daily, but will, about August 20, when the plant is complete, be running at full capacity of 120 tons daily. They use a Blymyer machine.

OREGON.

Portland—The Consumers' Ice Works, in Hulladay addition, will be ready to manufacture ice in a few days; capacity, 25 tons.

PENNSYLVANIA.

East Liberty—John M. Bruce will start his ice factory about August 1, the National Ammonia Co. having supplied the first charge of ammonia.

Uniontown—The ice factory is a decided success. Eleven tons are sold there each Saturday, all for home consumption.

SOUTH CAROLINA.

Chester—An ice factory is talked of, but nothing definite has been agreed upon as yet.

Florence—The Florence Ice Co., after erecting a 10-ton plant in connection with the electric light plant, found they had an insufficient water supply. This was remedied by sinking a four-inch well 120 feet deep, which furnishes an abundant supply, and the ice making machinery has been put in operation.

TENNESSEE.

Nashville—Meadows & Osgood have started up a new ice factory at South Nashville, Tenn. They are running at twenty-five tons daily; Hercules machine, with a reserve capacity of sixty tons daily.

TEXAS.

Abilene—A new ice factory has started up at Abilene, inspired by the success of the factory at East Abilene.

Arkansas Harbor—Will give bonus in the way of lots, etc., to parties who will locate an ice factory there.

Barnesville—It is reported that another ice company is to locate a plant.

Canadian—New machinery has been put in the Canadian Ice Factory.

Hillsboro—The city council has granted a franchise to a Boston syndicate for the erection of an ice factory.

Marlin—An artesian well is being drilled at Marlin, Tex., which is now over 1,400 feet deep. An ice factory is contem-

plated in that town, the erection of which will depend more or less on the success of the artesian well.

Mexia—The machinery of the new ice factory is being set in place.

Mineola—The citizens of Mineola, Tex., are negotiating with parties for the erection of an ice factory.

Rockwall—Rockwall, Tex., wants an ice factory, and the citizens of that town will offer splendid inducements to parties who wish to locate such an enterprise there.

Wichita Falls—The ice factory has begun making ice; capacity, ten to fifteen tons daily.

Wichita Falls—The Wichita Roller Mill Co. will build an ice factory, using their own power now utilized at the mill. They will begin building as soon as they can let the contract. The ice making machinery has not yet been purchased.

VIRGINIA.

Brambleton—Is to have another big ice factory. Work has been commenced on the building, and it will be completed within a short time.

Norfolk—The Mahoney wharf, warehouse and ice plant have been sold to Mr. John Pettit, of New York, who, among other improvements, will put the ice factory in operation.

Radford—F. Thomas contemplates starting an ice factory.

WASHINGTON.

Eugene—J. L. Hoffman is interested in an ice factory, to be erected this season.

Seattle—The Seattle Automatic Refrigerating Co. are talking of enlarging their plant. The local citizens' association are acting with the managers of the company.

Wynooche—A company has agreed to build a $12,000 or $15,000 ice factory here if the citizens will donate a site and $900 in cash, the money to be repaid by the company in ice at sixty cents per hundredweight.

ICE HOUSE AND FACTORY FIRES.

——The ice house at Fisher's Station, Ind., was burned July 13; loss, $1,600.

——The ice house at John Hubur's farm near Overbrook, Pa., was burned June 22.

——McKelvey & Co.'s ice houses, near Sandusky, Ohio, were burned July 15; loss, $10,000; no insurance.

——John Mules' ice house at Hudson, Wis., was burned July 16; loss, $700; no insurance; cause, unknown.

——Six large ice houses, the property of Swift & Co., of Chicago, were burned at Fond du Lac, Wis., July 15; loss, $8,000; 2,500 tons of ice were destroyed.

——On June 30 the ice houses of Robert Shafer, at Albany, N. Y., were burned; cause of fire, unknown; insurance $4,000 on house alone; loss of ice, uninsured, 18,000 tons.

——The warehouse of the Alton (Ill.) Coal & Ice Co. was burned July 6. Loss on house and ice (5,000 tons, of which a large part was destroyed), $5,000; insurance on building only, $2,000; cause, unknown, but thought to have been accidental.

——Adam Bonacker's ice house, near Greenbush bridge, Albany, N. Y., was burned July 5. The house, which was built last January, and consisted of three sections, and held 3,000 tons of ice, was destroyed, with the contents. Loss, $10,000; insurance on building, $4,000; cause, unknown.

——The Union Pacific ice house at the foot of Twenty-eighth street, Denver, was burned July 20, entailing a loss of about $1,500, fully covered by insurance. The building contained about 1,200 tons of ice, but suffered no more than 100 tons loss, by the burning of the shed in which it was stored.

——The new ice factory of the Collegeville Ice Mnfg. Co., at Collegeville, Pa., was burned by fire originating in adjoining premises, July 14; loss, $10,000 insurance $6,000. The ice company was formed about sixteen months ago, and had recently increased its plant on the earnings of the past year, the remodeled factory having begun making ice only a week before the fire.

ABANDONED PROJECTS.

——A new ice factory has been mentioned for Rome, Ga., but as yet nothing has been done.

——The new ice factory at Emporia, Kan., talked of some time ago, did not materialize.

——The two ice companies in Paris, Ky., have abandoned the idea of building ice plants, and the companies have disbanded.

——The ice factory at Luling, Tex., will not be in operation this season, as the proprietor failed to make it pay expenses last year.

——The erection of a new ice plant, contemplated at Owensboro, Tenn., by the Anheuser-Busch Brewing Co., in conjunction with local capitalists, has been postponed on account of lateness of the season.

——The effort to start an ice factory at Smyrna, Del., has failed, a canvass made to ascertain the daily consumption at home showing that it was inadequate to the amount necessary to justify the manager to proceed further. It was then thought advisable to put in a smaller plant, but this idea has also been abandoned.

ICY ITEMS.

——The Boston Ice Co., of St. Paul, has brought action against J. R. Fallis & Co. for $1,801.29 for ice delivered as per contract.

——The property of the New York Ice & Cold Storage Co., 207 Fulton street, in litigation, was sold by the sheriff June 30, for $16,100.

——Henderson & Belcher, of Far Rockaway, are supplying Rockville Center, L. I., with ice from the works of the Queens County Ice Manufacturing Co.

——The Automatic Refrigerator & Ice Machine Co., Muscatine, Ia., has been incorporated; capital, $1,000,000; object, to manufacture refrigerators and ice machines.

——The erection of the proposed ice factory at El Reno, O. T., has been postponed for the present season. Wichita and Ft. Reno now supply the ice used in El Reno.

——The Trans-Atlantic steamer "Wells City" put in artificial refrigeration with a Boyle machine this spring, for which ammonia was supplied by the National Ammonia Co.

——The Refrigerator Milk Can Co. has been incorporated at Chicago, to manufacture milk cans; capital stock, $25,000; incorporators, L. J. Cobb, C. G. Cobb and M. C. Farr.

——Letters from Iceland state that that island had a phenomenal winter, with never a flake of snow or an hour of frost. And the "ice man" at Reykjavik is now "catching fits" because he can't supply ice at 30-deg.-below-all-winter prices.

——Samuel Hiscox, who was one of the founders of the Knickerbocker Ice Co., of New York, died in that city July 12, at the home of his daughter, Mrs. W. A. Cole, at the age of ninety-five years. His son, Edwin Hiscox, is a member of the New York Produce Exchange.

——The Sunday law has invaded Greenwood, Miss., with a vengeance; and recently both the ice factory and the oil mill there were indicted by the grand jury for running their works on Sunday. The oil mill paid the fine of $100, but the ice factory people will appeal to a higher court.

——This season Judsonia, Ark., has shipped 13,760 cases and twelve refrigerator cars of strawberries. The local paper says picking the fruit gave employment to 2,000 people, some making as high as $3 a day. Without the refrigerator car this valuable crop would have been worthless because not marketable.

——They don't waste time in Texas, where "it's a cold day" when the sneak thief gets ahead of the ice machine. One night at 9 o'clock recently John Quesada, *alias* John Glanton, walked into the office of the San Antonio ice factory in the center of the city, held up the clerk at the point of the pistol, and relieved him of $17. He was arrested next morning, and within twenty-four hours was sentenced to fifteen years at hard labor. His crime, arrest and conviction furnish one of the quickest records in the criminal annals of Texas.

——The three-decked iron steamship Republic, of Philadelphia, running as a pleasure boat between that city and Cape May, is said to be the largest boat of the kind in the world. It is licensed to carry 3,000 passengers, and frequently as many as 2,000 are served with meals on board the vessel. Three meals are served daily. Tons of fresh meat, hundreds of chickens, great quantities of fish, vegetables by the cart load, berries in crates, milk in scores of cans, and huge boxes, barrels and baskets of other provisions are stored for use in its mammoth refrigerating rooms.

——The sheriff, May 14, took possession of the New York Ice & Cold Storage Co., at 206 and 208 Fulton street, on two executions, one for $39,799, in favor of the Fred W. Wolf Co., of Chicago, on seventeen promissory notes, and the other for $1,025 in favor of William J. Haskins, on a note. Bradstreet's reports state that the company was incorporated September 13, 1889, with a capital stock of $250,000, and was controlled by the Frederick Wolf Co., which erected the plant, and F. W. Wolf being the president. The company furnished cold storage largely to Washington Market butchers. The plant is valued at over $100,000. The annual report of January 21 said the liabilities did not exceed $148,000. The plant, when sold, brought something over $16,000.

——The Independent Ice Co. at Smithtown (Gardiner, Me.), have in operation at their houses a new device which is proving a great success as a money saver for the company, and it is the only one in operation on the river. Heretofore the ice has been packed in the hold of the vessel just as it came from the house, with the exception that it was hastily swept by a broom in the hands of a small boy who was not particular in his task. The Independents now run each block of ice as it comes out of the house into a chain, the lags of which carry it under a Briggs' planer, which removes about ten pounds of sap ice and chips from each block and leaves it in fine shape for packing. The great saving in space and consequent saving in freight rates on worthless ice, prove a considerable item of profit to the company.

ICE MAKING IN CINCINNATI.

A REPRESENTATIVE "BUCKEYE" FACTORY—DETAILS OF PLAN—THE ARCTIC ICE MACHINERY IN USE—COLD STORAGE FACILITIES.

Tentative attempts at mechanical ice making were made as long as sixty years ago: but it is only yesterday, so to speak, that it has become an active commercial economy, while even more recently has mechanical refrigeration come to be recognized as a practicable substitute for ice for all cooling purposes. Its practicability established, however, American capitalists at once undertook its development. As a consequence, in all the great commercial centers, ice making plants and cold storage houses have been erected for the use of the general public, who are rapidly coming to understand and appreciate their utility and merits.



ICE MAKING DEPARTMENT. ENGINE ROOM. COLD STORAGE BUILDING.

As indicative of the magnitude of some of these plants, ICE AND REFRIGERATION herewith gives an illustration of the buildings of the Cincinnati Ice and Cold Storage Co., at Court street and Eggleston avenue. This company, of which Mr. W. H. Field is president, and Edwin B. Thayer, secretary and treasurer, was organized in 1887 with a capital stock of $300,000. The general view of their buildings shows the cold storage room on the right, with a frontage of 117 feet on Court street, and a depth of 104 feet, eight stories high, into which cars from any railway entering Cincinnati may be run, for discharging for storage or removing all perishable goods and fruits. In the center is the engine room, with condenser above, while to the extreme left is the ice making department—the entire frontage being 290 feet. The ground plan and longitudinal sectional views, also given herewith, furnished by Geo. W. Rapp, the architect, of Cincinnati, will fully explain the details of the interior arrangements.

The ice making department and engine buildings are frame structures, covered with corrugated iron. The cold storage section, on the other hand, is built of brick with hollow tile inner walls, insulation being obtained by means of air spaces and mineral wool fillings between joists and the partitions separating the many rooms into which each floor of the building is divided. The plant, as a whole, has an ice making capacity of 100 tons daily, with cold storage capacity of 900,000 cubic feet. The machinery of the entire plant was erected by the Arctic Ice Machine Co., of Cleveland, Ohio, and consists of two 50-ton and three 25-ton machines.

This is one of the largest plants of the kind in the country, and has been eminently successful in every respect since it began active operations.



SECTIONAL VIEW CINCINNATI ICE AND COLD STORAGE CO.'S PREMISES.

TWO FROSTY TALES.

About January 27 of this year, just before the first heavy snow storm, William Kayser, who lives about five miles east of town, lost a hog, and was unable to find any trace of it, says the Leigh (Neb.) *World*. The other day, while one of his neighbors was digging a hay rack out of a snow pile, what did he find but the missing porker! After a fast of forty-two days the hog was still alive and able to walk around and eat. The animal weighed 375 pounds when it was caught out in the blizzard, but when found was reduced to about eighty or ninety pounds, and is expected to live.

A similar story is told by a South Dakota farmer. During the severe storm of February 7 and 8 he lost two turkey hens. He had long since given up looking for them and thought he would find them dead when the snow went away last spring. The snow had drifted high at one end of his barn. Late in March the farmer, when running over the drift, broke through and fell into a hole, when, behold, there were the turkeys. One of them was alive and as frisky as a kitten; the other one had evidently been dead a few hours. They had lived on snow for six weeks. The turkeys were fat when they were imprisoned, but very poor when found. The live hen is enjoying life again, but, on being liberated from its strange prison, was afraid of everything.

FOREIGN ITEMS.

ICE AT THE ISTHMUS—AN ABANDONED PROJECT—AN EXPERIMENTAL SHIPMENT OF BEEF—FOREIGN NOTES—SUCCESSFUL SOUTH AMERICAN INDUSTRY.

Seventy dollars per ton is now the ruling price for ice on the Isthmus of Panama.

* * *

England took from the Argentine Republic, in one month lately, as many as 300,000 frigorized sheep. There are preserving works in the Republic now handling 3,000 head per day, destined for exportation.

* * *

A steamer which recently arrived in London from Auckland, New Zealand, brought a cargo consisting of 40,000 sheep and 2,000 beeves, all dressed and frozen. This is the largest single cargo of dressed meat that has ever been brought to England.

* * *

Recently the refrigerating machine of a frozen meat steamer from Buenos Ayres to London, through some accident, gave out, off the Cape Verd islands. The cargo of meat, of course, spoiled, and was thrown into the sea, causing a loss of many thousands of dollars.

* * *

The town council of Barmen has voted 2,100,000 marks for the erection of a city slaughter house with refrigerating apparatus and chambers; the city of Mainz is also to have a slaughter house, for which nearly 2,000,000 marks have been set aside. Both of these establishments are to have every possible improvement in the way of stables, courts, running water, etc.

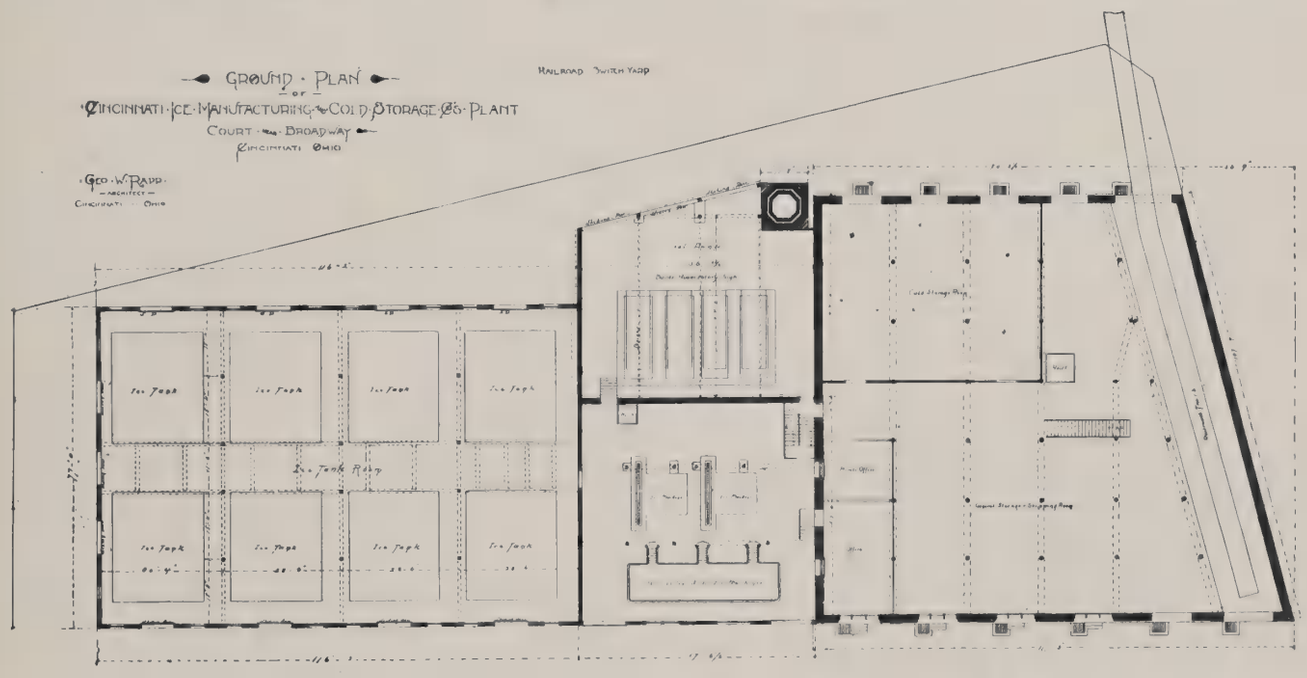
* * *

Two Norwegian engineers have constructed a model for an ice breaker, or, as they term the vessel, "fjord opener," on an entirely novel principle. Instead of the ice being broken as now by ramming, it is sawn through by circular saws working from the bow below the ice, which, by a supplementary arrangement, is thrown out of the channel cut in the ice, instead of left to endanger the safety of, or obstruct, vessels, as at present.

The West Indian Ice Co., which has been operating ice factories and cold storage houses in the islands of Trinidad and Barbadoes for several years, has made arrangements to establish a similar enterprise at Georgetown, British Guiana. The company has also contracted for a refrigerator steamer to sail regularly between New York and Barbadoes, Trinidad and British Guiana, carrying cargoes of fresh meats and vegetables from the United States on the outward voyage, and tropical fruits returning.

* * *

The Armour Beef Co., of Bangor, recently shipped a quarter of beef to Port-of-Spain, Trinidad, on the schooner Cora Dunn, which took out a cargo of ice loaded at the Orrington Ice Co.'s houses, Orrington, Me. Capt. Straker, master of the Cora Dunn, said that very little good beef can be obtained at Port-of-Spain, and that he wished to try an experiment which he had devised. The ice in the hold was placed at one point in such a manner that a sort of well was left near the deck. Into this well the beef was suspended, and if it arrives at Trinidad in good condition the captain intends to take a larger quantity on his next voyage with ice.



* * *

A late report of the management of the Argentine Meat Preserving Co., of Buenos Ayres, Argentine Republic, states, that the net profit earned amounted to £10,239 11s. 7d. out of which the sum of £10,005 has been applied to the payment of a dividend on the preference shares at the rate of 7 per cent per annum, leaving a balance of £234 11s. 7d. to be carried forward to next account. The directors consider this result of the first season's working to be satisfactory, seeing that it was impossible to get the new buildings and machinery erected in time for last year's operations, and that, consequently, the business could only be carried on as formerly. Owing to strikes and other causes, considerable delay occurred in obtaining delivery of the machinery required for the extension of the factory, and it was not without difficulty that it has been got into place for the present season. This, however, having been effected, the directors have every confidence that the result will be a satisfactory increase in the profits for the present year.

E. P. Bender, of Three Rivers, recently organized a company to establish extensive abattoirs at Three Rivers, Quebec, and ship frozen meat to England. The promoters included General C. C. Dodge and Benjamin Holmes, of New York, and the capital stock was fixed at $2,000,000. The project contemplated the importation in bond of cattle from the United States, which it was proposed to slaughter at Three Rivers, whence the meat would be shipped to England in steamers specially provided with cold storage. The refusal of the government to jeopardize the advantages allowed to Canadian cattle in England, in relaxing the quarantine regulations in regard to American cattle imported into the Dominion, having effectually stifled the Three Rivers scheme last year, during April Mr. Bender and Major Normand, of Ottawa, had an interview with Sir John MacDonald, the late premier, in relation to a revival of the scheme, who in laying their case before the premier, stated that the reason for asking permission to import cattle from the United States was that there was not sufficient stock in Canada to keep the industry going on a large scale. They desired, therefore, that the company would be permitted to import from the United States direct, and, instead of undergoing quarantine at the border, have the cattle brought to Three Rivers, which port could be considered a quarantine station. The intention of the company was to go into the slaughter of hogs and eventually utilize the cold storage room on their steamers for the shipment of large quantities of poultry. Sir John, having heard the representations of the deputation, promised to lay the matter before his colleagues, which he did. The ministers, however, refused to grant the necessary permission to carry the stock to Three Rivers in bond; and the project has been abandoned, for which the New Zealand shippers are, no doubt, duly thankful.



PACKING HOUSE NEWS.

——The Fort Dodge, Iowa, packing house, which had extended its season up to July, has shut down until fall.

——The Bloomington (Ill.) Pork Packing Co. will put in a refrigerating plant during the coming winter, at a cost of about $20,000.

——The Cudahy Packing Co. has purchased the Robert Eccles packing house at Los Angeles, which cost $72,000 when erected.

——Geo. Fowler & Son, of Kansas City, have incorporated, and since July 1 have been known as George Fowler, Sons & Co. (Limited).

——Cudahy Bros., of Chicago and Milwaukee, have begun to improve the 1,000-acre tract recently purchased near Buckhorn station, on the North-Western road.

——The American Dressed Meat Co., of Portland, Ore., has lately put up a glue factory in connection with the abattoirs, and is now putting in an engine and mill to grind bones for fertilizer.

——Saml. Effing & Co., pork packers, of Doylestown, Pa., are trying to get artesian water to supply their packing plant and ice factory. The first well was dry, and the second was dry to a depth of 350 feet. The drill is still at work.

——Reid Northrope, president of the American Refrigerator Co., has closed a contract with John Morrell & Co., of Ottumwa, Iowa, whereby that firm will have seventy-five refrigerator cars branded with the name of the firm.

——The Colorado Packing Co., of Denver, has put in a 30-ton Frick machine, which is about completed. The National Ammonia Co. supplied the first charge of ammonia, and the additional cold storage room will be in use early this month.

——The new packing house of B. M. Fernald & Co., at Bryant's Pond, Lewiston, Me., is now completed, and the machinery is being adjusted, which is of the most modern and improved pattern, requiring little more than half the force of the old style.

——There has been a decrease in the number of hogs packed in the country this season of 1,155,000, compared with last year; of which decrease Chicago shows 275,000; Kansas City, 226,000; South Omaha, 41,000. Cedar Rapids shows an increase of 29,294.

——The beef departments of the G. H. Hammond and Swift & Co. packing houses, at Omaha, have adopted the United States regulations for inspection, and will inspect pork as soon as the instructions are received. No cattle thus far have been condemned at the Omaha houses.

——Ira P. Darling, a well known packer of Chicago, died at Pawtucket, R. I., July 21. He was the senior member of Ira P. Darling & Co. He was forty-five years of age. Mr. Darling came to Chicago in 1878, and was employed by G. F. Swift & Co. At the end of three years he began business for himself, and in a comparatively short time amassed a large fortune.

——A corporation has been organized by Charles E. Marvin, president of the Puget Sound Dressed Beef Association, of Tacoma, Wash., to be known as the Puget Sound Stock Yards Co., to establish stock yards at Meeker Junction, midway between Seattle and Tacoma, for which purpose eighty acres of land have been purchased. As outlined, the plans contemplate an expenditure of $100,000 in buildings and improvements; not to include packing houses, however, which it is not their intention to locate at the new yards, which are intended to be simply a center for handling, feeding and marketing live stock.

RAILWAY REFRIGERATION NOTES.

——The Chicago & West Michigan Railroad Co. has just placed an order for 100 refrigerator fruit cars. They will have thirty tons capacity and be fitted with air brakes for fast service.

——The Erie wreck in June at Ravenna, Ohio, caused by reckless handling of a Swift refrigerator train, was duplicated in a small way at Hepburn, on the Erie, July 17, when another refrigerator train east bound ran into a construction train.

——The American Refrigerator Transit Co. has absorbed by lease the business of the Union Refrigerator Co., thus securing control of the 1,050 cars of the latter line, and the business of the Milwaukee brewers, who alone require 750 refrigerator cars for their business, the cars being marked with the names of the brewery using them. The American company is also operating the equipment of the Cold Blast Transportation Co., of Kansas City, consisting of 250 cars. Arrangements have also been made by which its service will be extended over the Union Pacific system, the same as on the Gould system, and will absorb that company's equipment of 500 cars. The same will apply to the Cotton Belt system, operating their equipment of 100 cars. Negotiations are now in progress which will probably result in the completion of a similar contract for the through business of the Erie system and the general business of the Richmond Terminal system, which includes the East Tennessee, Virginia & Georgia, the Central Railway & Banking Co. of Georgia, and the Richmond & Danville, absorbing what equipment they have at the present time, and which will probably require the construction of 500 to 1,000 cars in addition to the combined equipment, within the next twelve months, to provide the cars required to do the business of these lines.

MISCELLANEOUS NEWS ITEMS.

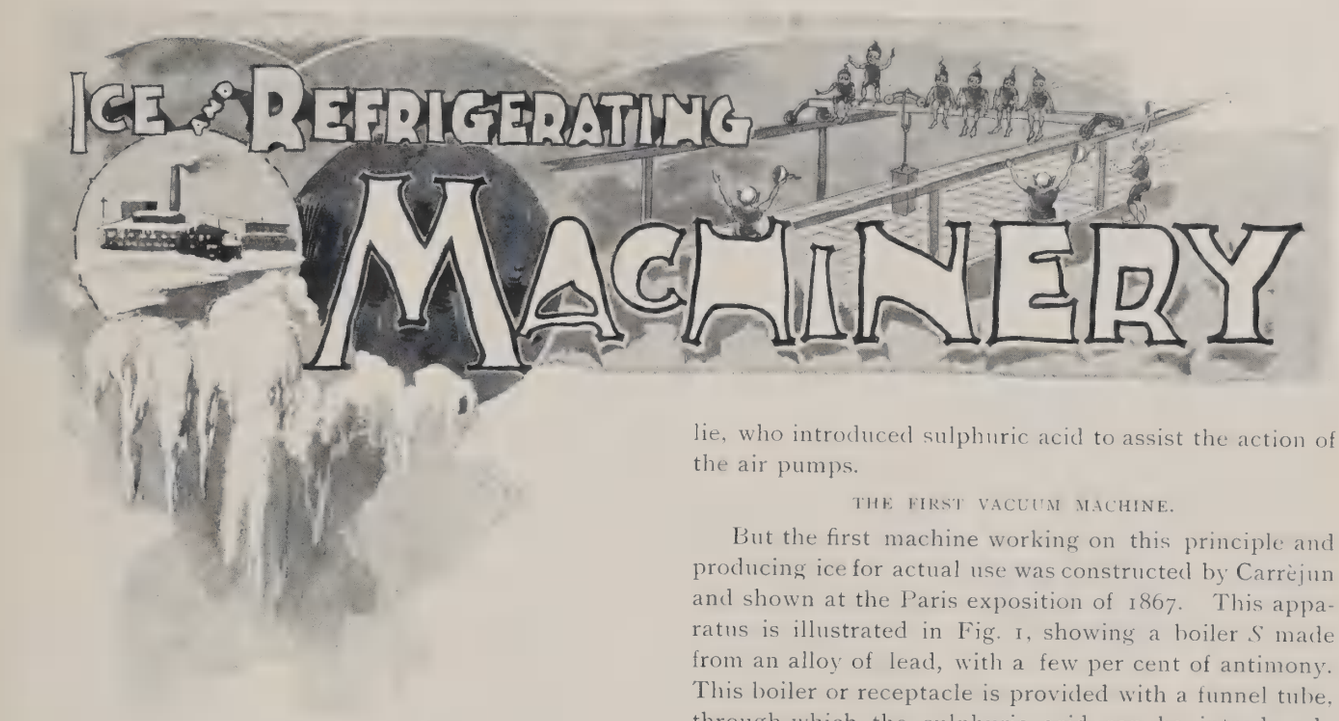
——The Alaska Refrigerator Co., of Grand Rapids, Mich., is just completing a new factory.

——Isaac Gronsky has purchased the ice factory of the Colorado (Tex.) Refrigerating Co.; price, $12,000. The plant is in operation.

——The Trotter Refrigerator Co., of Newark, N. J., is in the hands of P. R. Sleight, receiver, who will continue the business—at least until September 1.

——J. B. Skinner, president of the Hercules Iron Works, has purchased from the Fish Ice Co. for $85,000, its real estate and plant for manufacturing ice, on Throop and Jackson streets, Chicago. The ground is 120 × 168¼ feet. The ground is occupied by the buildings and ice plant, the latter having been erected about a year ago by the Hercules Iron Works, and costing $45,000. The ice machine plant is of fifty tons capacity, but is operated at the rate of fifty-five tons per day. Mr. Skinner will continue the operation of the ice plant, a number of large contracts for ice having recently been received.

——Dr. George L. Miller, of Omaha, has begun suit against the Crystal Ice & Coal Co. for $25,000 damages for failure to fulfill a contract to build a lake at Seymour park. He alleges that the ice company agreed to build a lake which should contain a depth of water of at least five feet, with proper embankments, and to keep in it filtered or purified water, supplied by a constant inflow. The ice company was to have the exclusive right and ownership of the ice crops produced and Dr. Miller to use the lake as a pleasure resort in summer. The ice company failed to build the lake by June 1, as the contract requires, hence the suit.



THE VACUUM ICE MACHINE.

ITS ESSENTIAL FEATURES AND CHARACTERISTICS—THE METHODS ADOPTED FOR PRODUCING A VACUUM, ETC.

The vacuum ice machine belongs to that class of refrigerating machines in which the cold is created by the abstraction or consumption of heat by the volatilization or evaporation of some more or less volatile substance. Its essential difference from other ice machines working on this principle, consists in that the refrigerating agent itself is rejected along with the heat which it has absorbed or taken up. From this it is obvious that hardly anything else but water can be used as the refrigerating agent, as it is the only liquid sufficiently inexpensive to be employed in this wasteful manner. However, as the water has a high boiling under the ordinary pressure of the atmosphere, and as in order to be useful the evaporation must proceed at a low temperature, a vacuum is required above the water to produce ebullition at a temperature below the freezing point. In order to do this the pressure above the water must be below 0.09 lb. per square inch: and as it is extremely difficult to maintain such a high degree of vacuum by simply mechanical means—air pumps, etc.—chemical means are resorted to, to increase the efficiency of the vacuum by absorbing the watery vapors as quick as they are formed. Concentrated sulphuric acid, or oil of vitriol, is the substance practically used for this purpose. The performance of this process, viz., evaporation of water at low temperature with the aid of a vacuum pump and sulphuric acid, is the object of the vacuum ice machine of the present day, which circumstance also accounts for its name.

The simplest form of such a machine is a vessel with water, from which the air, respectively the vapors forming subsequently, are rapidly exhausted by an air pump, when the water commences to freeze in the course of time if the vacuum is sufficiently perfect. In this way it appears that ice was first produced by Bullen in 1755, but only in the way of experiment. More practical results were obtained by Navine and subsequently by Leslie, who introduced sulphuric acid to assist the action of the air pumps.

THE FIRST VACUUM MACHINE.

But the first machine working on this principle and producing ice for actual use was constructed by Carrèjun and shown at the Paris exposition of 1867. This apparatus is illustrated in Fig. 1, showing a boiler *S* made from an alloy of lead, with a few per cent of antimony. This boiler or receptacle is provided with a funnel tube, through which the sulphuric acid can be introduced; while another tube at the bottom of *S* permits the withdrawal of the diluted or spent sulphuric acid. To this vessel or receptacle *S* an ordinary hand air pump *A* is attached, by means of which the air in the receptacle *S* and in the bottle *B*, containing the water to be frozen, can be exhausted. The bottle *B* is connected with the receptacle *S* by means of a rubber cork and the pipe *c'*. The faucet *r'* serves to close off the receptacle when the flask *B* is to be exchanged for another one. After a minute's pumping the boiling of the water in *B* subsides and the first needles of ice begin to form, which, while the pumping continues, soon increase, so that finally the whole contents of the flask *B* are converted into ice. In place of sulphuric acid other substances having an affinity for water, such as caustic soda, chloride of calcium, etc., can be used, but sulphuric acid seems best adapted for the purpose.

THE WINDHAUSEN VACUUM MACHINE.

This form of ice machine has been improved upon in various directions, notably by Windhausen, who connected the same with arrangements which enabled him to concentrate the spent sulphuric acid so that the same could be used over and over again. The first machine of this kind, as constructed by Windhausen, is illustrated in Fig. 2. The most essential part of the same is the vacuum air pumps *A*, having two cylinders from 0.8 and 0.22 meter in diameter respectively, making per minute fifty-five to sixty strokes. Furthermore, this machine is provided with six to eight freezing cylinders *C*, the covers of which are fastened at their lower ends by means of screws and rubber rings. The freezing cylinders are arranged at both sides of the absorber *B*, a horizontal iron cylinder provided with a stirring apparatus. The water runs into the freezing cylinders from the tanks *D* and can be regulated by faucets. It runs through pipes which are double walled, thus preventing their clogging up by freezing. The device for the concentration of the spent acid consists in the concentrator *F*, the exchange apparatus *G* affording a complete utilization of heat, the closed reservoir *H* for diluted, and the open reservoir *K* for concentrated acid. The mode of working is the

same as with the small machine, only that the successive working of two vacuum cylinders effects a more thorough and quicker evacuation. Only after a vacuum of one to two min. has been produced in the freezing cylinders, the water is allowed to enter them from the tanks *D* at a rate corresponding to their freezing capacity. In the course of time several improvements have been suggested by Windhausen, and one of the most recent forms constructed by him is illustrated in Fig. 3. The vacuum pump *A* is of the same kind as described in the foregoing machine, having one big and one small cylinder. *B* is the absorber, a cast iron cylinder of 0.9 meter diameter, and three to eight meters long, according to the size of the machine. It is filled to about two-thirds with sulphuric acid, kept in motion by a stirring apparatus. The absorber *B* is connected with a similarly constructed vessel *C*, called the refrigerator, in which salt brine or other liquids can be cooled down. This vessel is protected by bad conductors of heat, and the refrigerated liquid in the same removed and replaced by pumps. The sulphuric acid in *B*, which absorbs the vapors discharged by the liquid in *C*, is concentrated again in the concentrator *D*, which is provided by worms made of lead pipe, through which steam passes, and thus causes the evaporation of water from the acids. This concentrator works in connection with the heater *D*, and the exchange apparatus *D*. A small air pump *F* assists in the concentration of the acid. It is readily seen that this latter machine is specially adapted for the manufacture of refrigerated liquids, salt brine, etc., while the former machine is calculated for the manufacture of ice. Lightfoot, in a paper read before the Institute of Mechanical Engineers, says the following with reference to this machine:

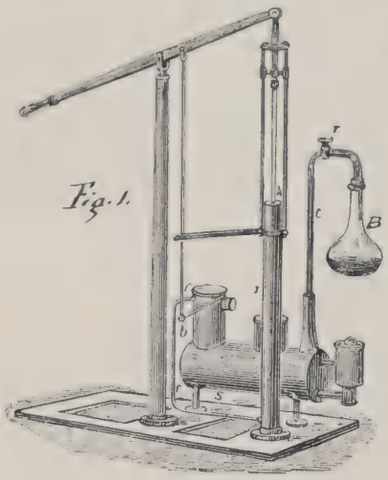


Fig. 1.

ICE DIRECT FROM WATER.

In 1878 Franz Windhausen, of Berlin, brought out a compound vacuum pump for producing ice direct from water, on a large scale, without the employment of sulphuric acid; and also an arrangement in which sulphuric acid could be used, the acid being cooled by water during its absorption of the vapor, and afterward concentrated, so that a fresh supply was rendered unnecessary. This apparatus was improved on in 1880; and in 1881 a machine nominally capable of producing fifteen tons of ice per twenty-four hours, was put to work experimentally at the Aylesbury dairy at Bayswater, being afterward removed to Lillie Bridge, where the author believes it now is. The installation was fully described and illustrated by Carl Pieper, in a paper read before the Society of Engineers in November, 1882, and by Dr. John Hopkinson at the Society of Arts about the same time. It consists of six slightly tapered ice-forming vessels of cast iron, of circular cross section, closed at their bottom ends by hinged doors with air tight joints, into which water is allowed to flow at a regular speed through suitable nozzles, the cylinders being steam jacketed in order to allow the ice to be readily discharged. The upper parts of these vessels communicate with the pump through a long horizontal iron vessel of circular section containing sulphuric acid, which, when the machine is in operation, is kept in continual agitation by means of revolving arms. The acid vessel is surrounded with cold water, which carries off most of the heat liberated during the absorption of the vapor. The pump has two cylinders, one double acting of large size, and a smaller single acting one. The capacities of these cylinders per revolution are as sixty-two to one. The air and whatever vapor has passed the acid are drawn into the large pump, which partially compresses and delivers them into a condenser. Here part of the vapor is condensed by the action of cold water, the remainder passing along with the air to the second pump, where they are compressed up to atmospheric

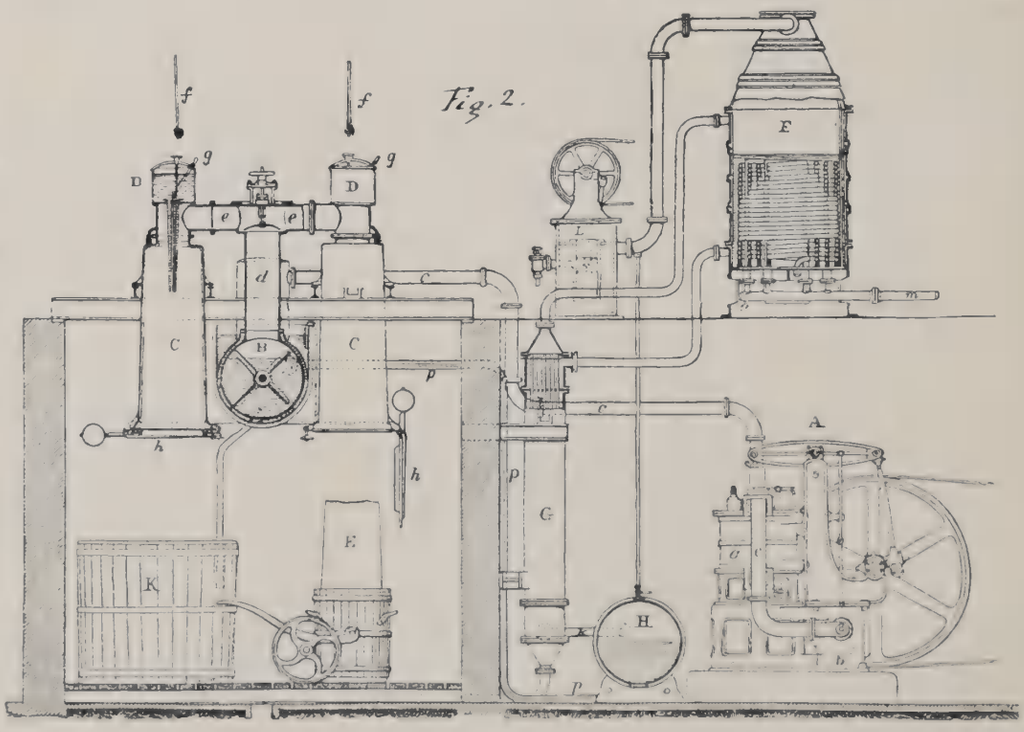
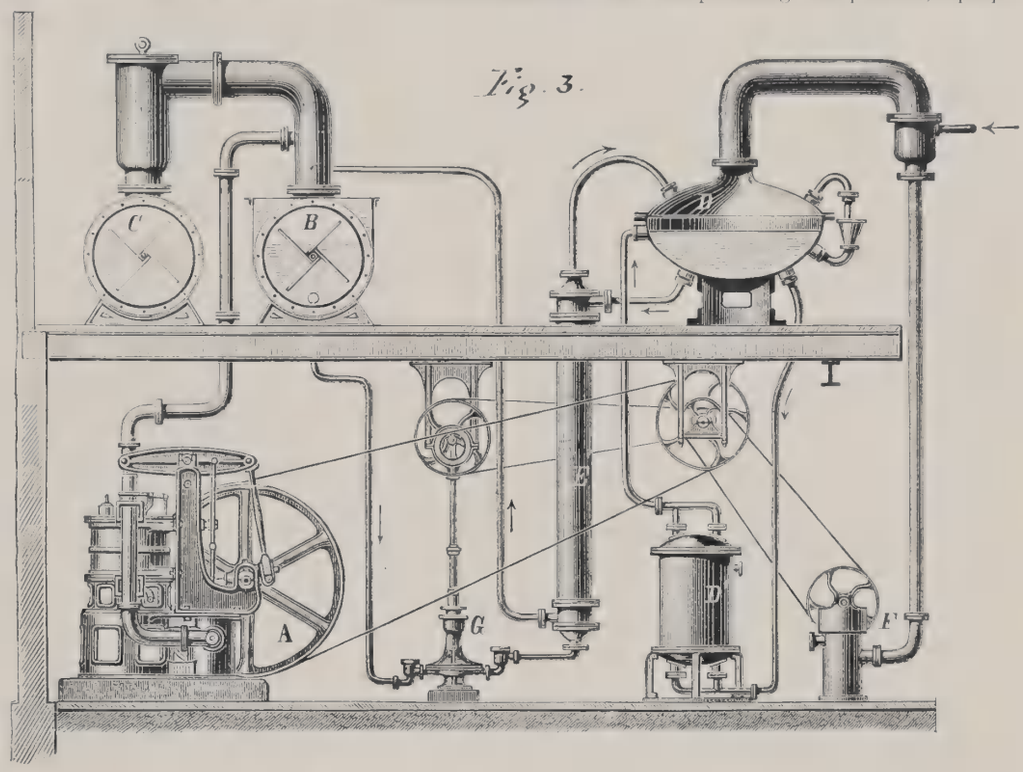


Fig. 2.

tension and discharged. The advantage gained by the use of a compound pump is due to the action of the intermediate condenser and to the compression being performed in two stages, by which the losses from the clearance spaces in the large pump are rendered much less than they would be if compression to atmospheric pressure were accomplished in a single

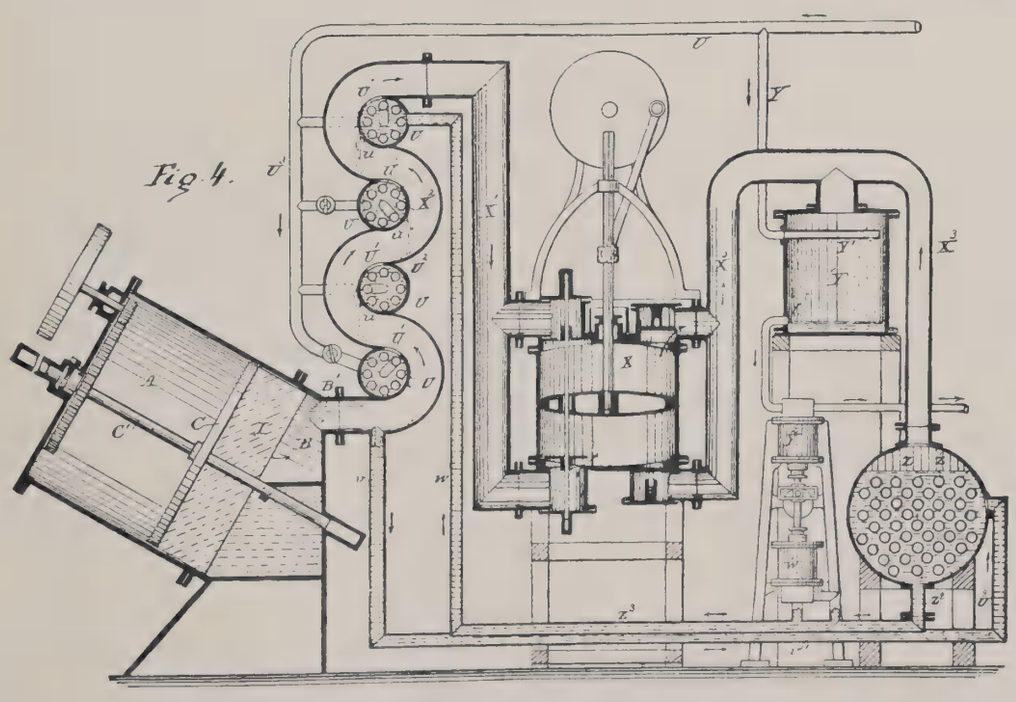
operation. The effect of the pump is said to be such that a vacuum of half a millimeter of mercury, or about 0.0097 lb. per square inch, can be continuously maintained; though in actual work about two and one-half millimeters or 0.0484 lb. per square inch is as low as is necessary. The concentration of the acid is effected in a lead-lined vessel, in which is a coil of lead piping heated by steam, the pressure in the vessel being kept down by means of an ordinary air pump. No acid pump is needed, as the transfer from one vessel to another is effected by the pressure of the atmosphere. The comparatively cool, weak acid on its way to the concentrator is heated in an interchanger by the strong acid returning from the concentrator. Six blocks of ice, each weighing about 560 lbs., are formed in about twenty minutes after starting. The charge of acid is said to serve for three makings of ice, after which it becomes too weak, and requires to be concentrated.

Fig. 3.



The water being admitted into the ice-forming vessels in fine streams offers a large surface for evaporation, and is almost immediately converted into small globules of ice, which fall to the bottom and become cemented together by the freezing of a certain quantity of water that collects there. This water being in a violent state of ebullition, the ice so formed is not solid, but contains spaces or blow-holes, which, as soon as the block is discharged from the vessel, become filled with air and cause opacity. Several attempts have been made to produce transparent ice by the direct vacuum process, but so far as now known, without success. Distilled water, or water deprived of air, has been tried, and hydraulic pressure has been used for compressing the porous, opaque blocks, but neither plan has been found practicable commercially. It would appear indeed that the only way to make clear ice by the vacuum process is by forming it in molds, subjected externally to the action of brine previously cooled by the evaporation of a portion of its water. The cost in this case would necessarily be greater: but the ice would be solid and transparent, and would consequently have a higher commercial value. The latent heat of liquefaction of water being 142.6 deg. F., the total heat to be abstracted in order to produce one ton of ice from one ton of water at 60 deg. F. is 382,144 F. pound units. Taking the latent heat of vaporization of water at 32 deg. F. to be 1,091.7, it is obvious that 350 lbs. must be evaporated to make the ton of ice. But in addition the sensible heat of evaporated water, which entering at 60 deg. would leave at about 32 deg., would have to be taken off: and this would require the evaporation of about nine and one-fourth pounds more, making a total of about 360 lbs., without allowance for loss by heat entering from without, which would be considerable. The total water actually used is given by Mr. Pieper at twelve tons per

Fig. 4.



ton of ice, including the quantity required for cooling purposes. The fuel consumption is stated to be 180 lbs. of coal per ton of ice; but the author understands a much larger quantity is actally required. It is consumed in generating steam for driving the vacuum pump and the concentrator air pump, and for evaporating the water absorbed by the acid. According to Dr. Hopkinson, the cost of making one ton of opaque ice is 4s.; but the author believes experience has shown that a much higher figure is required to cover the necessary expenses for repairs and maintenance, which in some parts of the apparatus are very heavy. Windhausen's machine has not met with any extended application in this country, owing no doubt to the opaque and porous condition of the ice produced by it and to the large and cumbrous nature of the plant, which must doubtless require great care and supervision in working.

OTHER VACUUM MACHINES.

Many other forms of vacuum ice machines have since been suggested and constructed, but we will close our remarks on this subject at present by a short reference to a machine designed by Patten, of New York. It is represented in Fig. 4 in its general features. N is a pump and communicates by means of the pipe N^1 with a worm-pipe N^2, which in turn is connected with the vessel B, so that all vapors must pass the pump, whence they enter a condenser Y, by means of the pipe N^3. Y^1 is a perforated water pipe terminating in the condenser Y^1. The water condensed in Y is drawn away by means of the pump Y^2. The sulphuric acid is furnished to the vessel U, provided with pipes through which water circulates and flows from the vessel U into the other vessels U situated below, and arrives in diluted condition in the pipe V, which carries the acid still warm into the boiler Z, where it is concentrated again. The concentrated acid flows through the pipe Z^2 back to the pump H^1, which pumps the same back to the vessel U for repeated use.

Besides the vacuum refrigerating apparatus constructed by Mr. Windhausen as mentioned in the above article, this gentleman has also constructed the compressed air refrigerating machine and a carbonic acid refrigerating machine, which differ in principle from each other, the latter machine being made in the United States by Ainslie, Cochran & Co., of Louisville, Ky.

NEW LIQUIDS FOR ICE MACHINES.

Recently mixtures of sulphurous acid with hydrocarbons, have been recommended as refrigerating media or ice machines by J. Quiri, of Strassburg, Germany. If liquid sulphurous acid is mixed with either one of the following hydrocarbons, viz.: Isobutylen (C_4H_8, boiling point, 21 deg. F.), propylen (C_3H_6, boiling point 22 deg. F.), butan (C_4H_{10}, boiling point 32 deg. F.), or with pentan (C_5H_{12}, boiling point, 90 deg. F.), oily liquids are obtained, which, if used in refrigeration, make the lubrication of the compressor piston superfluous. Isobutylen is obtained by heating 100 parts of isobutyl-alcohol, 100 parts sulphuric acid, 40 parts sulphate of potash, 160 parts powdered glass, and 20 parts of water. Propylen is made from propyl. alcohol, with chloride of zinc; and butan and pentan are obtained from mineral oils. For the mixing of either of these hydro-carbons with sulphurous acid, two vessels of iron are used, which stand one above the other, and are connected by means of a leaden pipe. The lower vessel is placed in a cooling mixture, and contains the required amount of hydro-carbon, to which the proper amount of sulphurous acid is allowed to flow from the upper vessel by means of the leaden conducting pipe.

LATENT HEAT OF EVAPORATION.

The latent heat of evaporation of several volatile bodies used in ice machines has been recently determined by J. Chappius, at 32 deg. F., with the following results:

	1 Kilogram.	1 Molecule.
Chloride of methyl	96.9 Calories.	4,860 Calories
Sulphurous acid	91.7 "	5,900 "
Carbonic acid	56.3 "	2,480 "

It will be observed that these figures refer to metric calories.

THE London *Meat Trades Journal* recently published an interesting table relative to England's dead meat imports in 1890. The figures show a very remarkable increase. In 1888 the total quantity of beef imported was 836,659 hundredweights, while last year's imports were 1,854,593 hundredweights, or 471,222 more than in 1889. Of the total for 1890, no less than 1,693,148 hundredweights came from the United States, the imports from this quarter being stimulated no doubt by the publication of the profits of the importing firms which were converted into joint stock companies. Notwithstanding the increase in the dead meat trade, there were 83,365 more cattle imported in 1890 than in the previous year. The mutton imports last year were 1,656,419 hundredweights, against 1,227,562 in 1889, 988,010 in 1888, and 784,841 in 1887. The contribution of New Zealand in 1890—787,322 hundredweights—exceeded the total imports of 1887. Last year's importation of mutton from the Argentine amounted to 435,084 hundredweights.

THE ice box should receive much care and attention to keep it sweet. Wash frequently and wipe dry; cleanse the waste pipe often with washing soda, and do not let bits of stale food accumulate. Fresh meat should be put carefully upon clean earthen dishes. The butter jar should always be covered with a close cloth, and a plate or other cover laid over that. A few lumps of charcoal in the ice box are a good thing; put fresh bits in now and then; they absorb odors quickly."—*Ex.* Yes, and we imagine that if the average housewife would just take this little advice to heart and act on it a few times during the season, she would have fewer complaints to make about "the nasty, dirty ice" she thinks she gets.

A LONDON firm, which has branch houses in Adelaide, Melbourne and Sydney, Australia, are building on the Clyde a number of ships for meat transportation from Australia to England. The vessels will contain compressed air refrigerating machines for cooling the frozen meat compartments of the boats, and to cool the decks on which live stock are carried.

"MICROBES have recently been discovered by a Russian scientist in snow, hail and ice. Nine varieties are detailed."—*Ex.* There it goes again! There is said to be a "land fairer than day"; but what we really want to know is, is there a land where the microbe and the "microbe fiend" are "barred"?

ICE AND REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE AND THE TEXAS ICE MANUFACTURERS ASSOCIATION.

∴ AUGUST, 1891 ∴

SUBSCRIPTION PRICE, $2.00 PER ANNUM.

H. S. RICH & CO.

PUBLISHERS.

177 La Salle St., Cor. Monroe, CHICAGO.

206 Broadway, Cor. Fulton, NEW YORK.

Entered according to act of Congress, in the year 1891, by H. S. RICH & CO., in the Office of the Librarian of Congress, at Washington, D. C.

SEND IN YOUR SUBSCRIPTION.

If you have not already subscribed to ICE AND REFRIGERATION, *your attention is directed to the inclosed subscription blank, which we will be pleased to have you sign and return. If you are a subscriber, please hand subscription blank to some one who may in any way be interested in the subjects covered by* ICE AND REFRIGERATION.

POST-PRANDIALLY.

The publishers of ICE AND REFRIGERATION, in the initial number, July, took occasion to publish, with thanks, a number of kind words received in answer to the prospectus of the new journal, which had been mailed some weeks before that issue appeared. These letters were most encouraging, and were deemed somewhat of the nature of the blessing that precedes the banquet. As purveyors to the feast, the publishers appreciated the fervency of that blessing, and therefore disclosed the feast to the banqueters with natural and sincere solicitude, though feeling at the same time that they really had made a good effort, and were setting before the banqueters something they had never seen before.

Now that the feast has been discussed, and not the faintest symptom of an indigestion has appeared, the publishers feel that the "post-prandial" speeches, too, should see the light; and therefore again take the liberty of publishing the comments received by us, at the same time thanking our friends who have thus taken the trouble to express their appreciation of our work and to encourage us to win their "good words." Speaking to a thought suggested in some of the letters, the publishers plead guilty to having "aimed high," but at no time will our efforts be relaxed to hit that exalted mark at every issue, and thus continue to merit the high praise lavished on the first issue.

[ST. LOUIS AUTOMATIC REFRIGERATING CO., St. Louis.]

At first glance ICE AND REFRIGERATION looks first-class, and as if it was destined to be the finest trade paper in the world.

[JAS. E. EGAN, Supt. WACO ICE & REFRIGERATING CO., Waco, Tex.]

I am well pleased with ICE AND REFRIGERATION in every respect. It is just what we want, and we think that every ice manufacturer in the country should subscribe for it. We wish you unbounded success. Do not fail to send our numbers regularly.

[F. M. POLHAMUS, TEXARKANA ICE CO., Texarkana, Texas.]

The first copy of ICE AND REFRIGERATION, just received, exceeds my most sanguine expectations. You certainly have brought out a complete surprise for us all. The editorials and general make-up of the magazine, are first-class, while the workmanship in the printing and litho. work is the very best. To say you have achieved a perfect success in the initial number is sufficient, and that you will have every success is our wish.

[EAST FLORIDA ICE MFG. CO., per S. BENJAMIN, Ocala, Fla.]

ICE AND REFRIGERATION can be made indispensable to the ice manufacturers, and I will with pleasure advocate its adoption at the next meeting of the Florida manufacturers.

[NATIONAL AMMONIA CO., St. Louis.]

We are much pleased with the first number of ICE AND REFRIGERATION, and have no doubt it will meet with the general favor that it merits.

[AINSLIE, COCHRAN & CO., Louisville, Ky.]

We are much pleased with the result of our advertisement in ICE AND REFRIGERATION. Inquiries come pouring in, and it keeps us hustling to answer them all.

[ALLEN P. WALKER, Gen'l Mngr. WYTHEVILLE ICE & DAIRY CO., Wytheville, Virginia.]

I have carefully examined Vol. I, No. 1, of I. & R., and am very much pleased with its contents; in fact, it is a book long needed by our class, and I am sure it will meet with success to you all, as well as benefit all who are interested in such work. Please do not miss a single issue, as I want to keep them on file.

[BAKER & VICKERY, Butchers, etc., Belton, Tex.]

Are well pleased with ICE AND REFRIGERATION, and see that it is something that every ice machine man ought to subscribe for. Therefore, we inclose price for subscription for one year.

[FORT PAYNE ICE & COLD STORAGE CO., Fort Payne, Ala.]

ICE AND REFRIGERATION we find to be very complete, as well as valuable in its composition.

[PUEBLO DIST.-WATER ICE & COLD STORAGE CO., Pueblo, Colo.]

We are highly pleased with ICE AND REFRIGERATION, and think you have struck a bonanza in entering this new field, as no ice company or ice machine man can afford to go without it.

[PFAUDLER VACUUM FERMENTATION CO., Rochester, N. Y.]

The new paper, ICE AND REFRIGERATION, is magnificently gotten up, and is bound to be a grand success. You will, of course, send it to us regularly.

[F. S. ALLINDER and GEO. MOIR, Engineers for B. C. I. & C. S. Co., Fort Smith, Ark.]

After fifteen years of darkness, we now have a beacon light to guide and instruct us. It is every engineer's duty to subscribe for ICE AND REFRIGERATION, and help to keep it up to its initial excellence, by contributing to its columns, and thus be benefited a hundred-fold in return.

[P. M. SAUVIGNET, Prop. LAREDO ICE CO., Laredo, Tex.]

I have received ICE AND REFRIGERATION, and am very much pleased with it, and think it will be a great help to the trade—just what has long been needed.

[SANFORD ICE CO., Sanford, Fla.]

We feel that ICE AND REFRIGERATION meets a long felt want in the ice trade, and we wish you every success in your enterprise.

[THE WEHR-HOBELMANN-GOTTLIEB BRG. & MALTING CO., Baltimore.]

Permit us to compliment you on the success of your ICE AND REFRIGERATION. We wish you and your very excellent paper a long and prosperous life.

[CARTHAGE ICE & COLD STORAGE CO., Carthage, Mo., C. M. GAY, Mgr.]

Your July number of ICE AND REFRIGERATION is at hand. Let her come regularly. In your hands it is bound to be a success.

[T. M. SINCLAIR, Packer, Cedar Rapids, Iowa.]

Our draft to cover subscription attests our approval and appreciation.

[PURE ICE & COLD STORAGE CO., Springfield, Ill.]

We are just *overcome*. Your Vol. I, No. 1, of ICE AND REFRIGERATION is far ahead of our expectations, and we are proud of it. Here is our ☞. Long may you wave. If we can help you, call on us.

[W. E. BLANCHARD, Engineer with ARK. & TEX. CON. ICE & COAL CO., Vernon, Tex.]

I think ICE AND REFRIGERATION a good young journal. I have had several years' experience in ice manufacturing, and I think your journal a good one on the subject, and I find lots of good reading in its pages. I am always seeking for all the information I can get; and I am always glad to see the ideas of others.

[SIOUX AUTOMATIC REFRIGERATING CO., per FRED W. ADGATE, Chief Engineer, Sioux City, Iowa.]

Please find inclosed my subscription for ICE AND REFRIGERATION. She is a beauty, and fills a long felt want.

JUST THE THING.

We commend to the readers of ICE AND REFRIGERATION the following extract from a letter written by Messrs. Allinder and Moir, the intelligent engineers at the factory of the Border City Ice and Cold Storage Co., Fort Smith, Ark.:

It is every engineer's duty to subscribe for ICE AND REFRIGERATION, and to help keep it to its initial excellence. By *contributing a few lines to its columns* you would be benefited a hundred times in return.

We cannot too strongly express our desire to receive communications from engineers and proprietors on points that arise in the daily practice of operating an ice factory, or cold storage plant, or in the handling or storing of natural ice. Were each individual who receives ICE AND REFRIGERATION to contribute even a little from month to month (and each one could, if he would), there would be created a fund of technical information that would be of incalculable value to the trade. Every man has to solve problems of practice almost daily. That experience reduced to writing might be of immense value to his neighbor, who in his turn solves (and explains the solution of) a problem he, too, has worried over, and thus an exchange of experience benefits both; each reaps a benefit. Do not imagine your experience is too trivial to record. It is the little things that make life; it is the little annoyances that by multiplying make life a burden; it is the petty losses of time or product that consume the profits; and these losses may be avoided by just such an interchange of experience as this plan for their publication contemplates. Write them out and send them in. Don't worry about "fine writing"—nobody cares for that. What is wanted is the facts expressed in common, every-day English; and the editor can put on them all the polish they need, which, we are sure, will not be much.

THE PURITY OF ICE.

There is, as ICE AND REFRIGERATION endeavored to show last month, no reason why the dealers in natural ice and those handling manufactured ice should quarrel; nevertheless, petty quarrels between them have appeared in several places throughout the country, which have been industriously encouraged by the press, resulting in a condition of bad feeling that can ultimately result in no good to either party.

This quarrel, in the press side of it, has taken the very undesirable character of a mutual attack on the purity of the ice handled by each. Now, while neither party can find any reasonable basis for the charges and counter-charges made, the question is one, after all, that had better be dropped. At any rate, its discussion by the trade itself can do no one the slightest benefit; rather such discussion will likely result in more harm than good even if a temporary advantage is gained by either side. For in these days of bacteria, microbes and germs, of cranks who see sand and whiting in sugar, alum and ammonia in baking powders and bread, death in a ham or a slice of dried beef, *ad lib.*, the discussion of "purity" upsets more minds than it satisfies, and causes uneasiness and decrease of consumption; for no matter how conclusively the purity of ice may be demonstrated to reasonable men, the fact remains that a vast part of humanity seem to take a delight in nursing the disagreeable and in believing the worst. Mankind in reality is pessimistic, not optimistic.

To this question of purity, there are, as to all questions, two sides. For instance, one of the things said of manufactured ice was the statement recently made by a New York butcher, and repeated in a printed interview by one of the most prominent men in the natural ice trade of New York city, to the effect that, if you take a block of manufactured ice, and, on getting at the center of it, rub your hands over it, you can smell the ammonia on your palms and the oil of the machinery on your fingers! The late Baron Munchausen is reported to have said, when this *bon mot* was repeated to him by the later Mme. Blavatsky, "Well, I left behind me on earth the record of having been something of a liar myself, but I wouldn't be 'in it' in these times. The ice machine man has sprung a 'cold day' on me, and I'm 'left'!" It is not possible that there exists an ice dealer in the world who could truthfully be guilty of so absurd a *faux pas;* yet it is certain that among intelligent men, who are consumers, such erroneous ideas of the quality of manufactured ice do obtain, for we have ourselves encountered those who really believed that the man who used manufactured ice did it at the risk of poisoning by free ammonia contained in the ice—having somewhere heard that "ammonia is used in making ice." Every dealer in manufactured ice has, doubtless, at one time or another, met just such people. The story has been circulated extensively from mouth to mouth, and even the great metropolitan daily newspapers have repeated it time and again, and in all seriousness; and so the controversy on this point has raged more or less violently from New York to Denver. It was undoubtedly an attack of this kind that induced the ice factory at Zanesville, Ohio, to publish a chemical analysis of the ice made by them. This report is interesting and worth repeating, since analyses of ice made from distilled water would practically agree in most cases with the one here mentioned. This analysis was made by Mr. Karl L. Langenbeck, chemist to the American Encaustic Tiling Co., of Zanesville, Ohio, of a block of ice taken at random, June 27, from the wagons of the Zanesville Artificial Ice Mfg. Co., which, says Mr. Langenbeck, in his report dated July 1, 1891, gave the following results:

"One hundred thousand parts, by weight, of the melted ice were found to contain: 2.7 parts of total solid matter, containing but a faint trace of organic matter; .4 parts of chlorine; .004 parts of free ammonia; no albuminoid ammonia; no sulphur compounds; no nitrous acid.

"No terrestrial water, not even that of Loch Katrine, near Glasgow, contains so small an amount of solid matter. The claim, therefore, that the ice was made from distilled water is strictly true, the small amount of residue present having been carried over mechanically by the steam, an unavoidable matter in all processes of distillation conducted on the large scale. This fact is further proven by the composition of the residue, which consists of a little clay, oxide of iron, chalk and a minute trace of salt, all constituents, though in much greater amount, of the city water. The absence of 'albuminoid ammonia,' sulphur compounds and nitrous acid, shows the entire absence of decomposable animal and vegetable débris. The minute amount of free ammonia shows that the ice is perfectly protected from even accidental contact with any chemical in the process of its manufacture. All natural waters contain ammonia, resulting either from the decomposition of nitrogenous matter of vegetable or animal origin in the soil, or, in the case of deep wells, from the reduction of nitrate salts in the

earth. The ammonia found present was unquestionably derived from the original water used for distillation, the amount being much smaller than the majority of the best drinking waters contain.

"I venture to say that no drinking water is obtainable in this locality that can compare in purity with this ice."

On the other hand, the manufactured ice dealer cites the statements of Dr. Prudden, who made an examination of Hudson river ice, finding bacteria therein, and the action of the Massachusetts legislature in directing the state board of health to "make special investigation with reference to the pollution of ponds, lakes, streams," etc., from which the ice supplies of that state are largely obtained. It being true that the common belief that all impurities in the water from which ice forms are, under all conditions, excluded from that ice in the process of freezing, is erroneous, for the purposes of a retort in kind it is assumed that, therefore, all natural ice is likely to be impure and unwholesome. Now, of course, it is well known that a large number of bacteria of one kind may be harmless, and a small number of another kind may communicate a most serious disease. It is known, from experiments, that many kinds of bacteria survive a long season in ice: and it has been shown by Dr. Prudden that the bacillus of typhoid fever will live in decreasing numbers in ice for three months at least. It is, then, the quality of the bacteria rather than the quantity that is to be considered, and the best judgment in regard to this includes the source from which they came. If the source is one which is liable to be polluted by disease-producing bacteria, as is likely to be the case wherever sewage enters, this fact should have much more weight than the small number of bacteria found.

Now, in response to circulars sent to local Massachusetts boards of health, physicians, etc., 189 replies were received by the state board, and the sources of pollution noted in thirty cases. In October the water from each of these thirty localities was examined, and later the ice formed on these waters was examined, which latter examination showed that the color and salts of the water and all but 13 per cent of the other impurities had been removed by freezing. The number of bacteria in the ice average 138, being increased by one sample of snow ice that contained 1,246 per cubic centimeter, while the clear part of the same cake showed but 6. Two samples showed none; three had less than 10; three others between 10 and 100, and two had respectively 199 and 433. A sample of clear ice from an unpolluted source was found to be nearly as free from organic impurities as distilled water.

From the examinations made the board says that, "It appears probable that, when ice first forms on the surface of a pond or river, a considerable part of the impurity in the water near the surface is entangled in the first inch or less in depth, and that the ice that forms below this first inch contains but a very small percentage of the impurities of the water. If snow falls upon the thin ice, causing it to sink, so that water from below saturates the snow, it will freeze without purification; or, if rain falls upon the snow and freezes, the ice thus formed contains the impurities of the snow and of the rain water, and whatever else may have settled out of the air. The method often pursued of flooding the ice of a pond or river by cutting holes through it, gives a layer of ice as impure as the water of which it is formed." And in general the board adds: "The results obtained lead to the conclusions that, while clear ice from polluted sources may contain so small a percentage of the impurities of the source that it may not be regarded as injurious to health, the snow ice and any ice, however clear, that may have been formed by flooding, is likely to contain so large a percentage of the impurities of the source, and with these impurities some of the disease germs that may be in the source, that the board feels bound to warn the public against using ice for domestic purposes that is obtained from a source polluted by sewage beyond that which would be allowable in a drinking water stream or pond; and that in general it is much safer to use, for drinking water and for placing in contact with food, that portion of the ice that is clear."

It may be added further, that the board says: "The answers to the third question (included in their circular, to wit.: 'Have any cases of illness come to your knowledge from the use of ice cut from such [polluted] sources?') were generally 'No.'"

It appears, therefore, that the most captious will agree that ice cut from a lake, pond or stream, the water of which is suitable for drinking purposes, is wholesome for all purposes to which ice is put; especially so when clear and unaccompanied by a layer of snow ice; and that ice cut from a polluted source is not necessarily unwholesome when clear. In practice ice men have long recognized this fact, and in cutting have sought to do so in all cases from the rural streams and lakes, and thus avoid polluted sources. It is perhaps true that some Hudson river ice might contain deleterious impurities, as might also some ice used in the large cities that is cut adjacent to them; but as a matter of fact, the great bulk of the natural ice consumed in this country is cut from wholesome streams and lakes, and is in fact as wholesome as manufactured ice, than which there can be none better. The slight organic impurities found in nearly all ice are harmless, and may be removed from the water of melted ice, by the simple use of filter paper.

For this reason it is unfair to both sides of this public controversy now going on in certain places, to continue it on these lines; and its continuance, as shown, can result in no possible permanent advantage to either, because, in fact there is no sound basis for the charges made on either side. The advice of ICE AND REFRIGERATION would be, in the language of Mr. Wegg, "Drop it."

IN JERSEY some of the cities have adopted the scheme of putting a license tax on ice delivery wagons. As it does not appear that a tax has as yet been levied on the delivery carts of the grocers, butchers, dry goods, and other business houses, the economist who can define conclusively the distinction between these various deliveries, is the man who has so long been sought for to formulate the difference between tweedle-dum and tweedle-dee.

A DENVER paper says that office has the name of "an eastern party" who will put in an ice plant at that city inside of forty-five days if local capital will assume the business when the plant is completed. A score of such eastern parties can be found at the "drop of the hat." The same paper predicted the fall of the present Denver ice "combine" by the first of August. Others are talking of a new company to get ice at Twin Lakes.

THE FRIGORIZED MEAT EXPORT TRADE.



MEAT exportation from the United States is one of the most important of American industries, being a conspicuous part of the total volume of exports of farm products, which, as all know, are many times greater in volume than all other exports of the United States combined. Any facts, therefore, which relate to this great industry cannot fail to be of interest; and more particularly any statement of facts which would indicate a substantial foreign competition with our own American shippers in this important line of export.

It will be recognized that modern systems of refrigeration, in the abattoirs and in transportation, have practically revolutionized the business of handling dressed meats as regards inter-state trade. By means of these newer appliances, the monster packing houses of Chicago, Kansas City and other great cattle marts, have become the great slaughtering houses of the country, shipping their product of dressed meats to their own cold storage depots in all parts of the Union, whence they are distributed as the trade demands to the meat stalls, and through them to the ultimate consumers, the people.

By this means, too, these same cities have also become the slaughter houses of the great European centers of meat consumption; and the manner of shipment, with some figures indicating the enormous volume of this business, will later on be the subject of review in ICE AND REFRIGERATION.

In the meantime, it will be interesting to see how the very means employed by Americans to extend and broaden their own trade in dressed meats have been utilized by their foreign competitors in the antipodes to make inroads upon that profitable trade. It is well known that the Argentine Republic and the British colonies in Australia have already become great stock raising countries; but the uninitiated are, we think, inclined to give more importance to their exportation of hides and wool, than of meat. Such has, indeed been, until in more recent years, the leading character of their exports, the great plains of the Rio de la Plata being even now literally strewn with the bones of millions of cattle slaughtered for their hides alone. The art of mechanical refrigeration has, however, given a value to the carcass, thousands of which now go to feed the populations of the continent. Even greater, in proportion to area and population, is the competition with America in the dressed meat trade of Europe which now comes from the islands of New Zealand, the city of Christchurch, situated on the eastern shore of the middle island, being the chief point of export. A recent letter on this topic in the *American Mail*, by a resident of Christchurch, is so interesting and complete, that we quote it entire, without further comment. The letter is dated April 22, 1891, and is as follows:

"* * * I propose to give you a brief sketch of the frozen meat trade. Judging from certain circumstances connected with the McKinley bill it would appear that your meat shipments are reckoned not the least important part of your exports, so that I count on a certain degree of interest in the subject for its own sake; but, apart from that, I may say at once that it is impossible to appreciate the position of New Zealand to-day without some knowledge of this remarkable trade. Since the first 400 carcasses reached London in 1880, New Zealand has taken a leading part in its development, and there is perhaps no more striking testimony to the energy and commercial ability of the colonists than their success in establishing and developing a business in which there was everything to learn and an unusual number of difficulties to contend with.

"First of all, the leading spirits had to persuade their fellow-merchants and sheep farmers to take shares in the various companies formed to freeze and ship the meat. There were doubts of the success of the freezing process, doubts whether a market would ever be found for the meat when it was landed and thawed, doubts whether the country could afford to send its sheep away in the wholesale manner proposed. However, the doubters were satisfied more or less, and the companies got to work, Canterbury as usual leading the way. The freezing process proved perfectly reliable, if honestly maintained, although the disposition of the ship captains to economize coal on the voyage often led to the temperature going up in the meat chambers, and to the damage of some carcasses. This still remains a grievance with shippers of frozen meat, and negotiations are now in progress which will probably end in responsibility being placed on the shipping companies for the safe delivery of their cargoes, in which case we may rely upon the freezing machinery being always maintained at its proper power.

"The difficulty of making a market for the meat was soon overcome; the supply has been constantly increasing, yet the demand has as constantly kept pace with it. That is, as far as the mere sale of the meat is concerned; but what New Zealanders most ardently desire—the sale of the meat under its own name—is only just beginning to be brought about. There was not only John Bull's innate prejudice against anything new, especially anything new to eat, but there was also the mighty trade interest of the London market salesmen and the London butchers to contend against. These gentlemen bought the meat, bought every year more and more of it—but sell it! Not they. The inquiring New Zealander has before now walked into the London butcher's shop, and admired his own brand on the carcasses hanging around. He has then asked the butcher for a joint of New Zealand mutton, and has been met with the emphatic assurance that it is not kept in that shop. 'Wouldn't have a joint of it in the place.' The primest sheep are always bought by the West End butchers, and are retailed by them as best Scotch or English at 1s. 2d. and 1s. 3d. per pound. No doubt if it paid to send prime Vermont sheep from your side, and they were regularly shipped to London, it would be just the same—not a butcher would own to selling them.

"All this tends to get the back of the New Zealander up, and the consequence is that lately shops have been opened for the special, open, declared sale of New Zealand mutton, and this not only in London, but in various other towns throughout England. It is hard to convince John Bull, but the feat can be accomplished, and we have reasonable hopes of ultimately procuring for our mutton the good repute which it deserves, but of which

at present it is robbed. When that time comes we hope that instead of selling at 4½d. per pound it will fetch 6d. or 7d.; the rise would put hundreds of thousands of pounds on to the value of land and stock in the colony. As to the third difficulty—the faint-heartedness of those who thought we could not spare any sheep—it was triumphantly disposed of at the end of one year's operations, when it was found that in spite of the exports the number of sheep in the colony had increased. So it has been every year since, until in May of last year the total sheep stock was 16,200,000. The export of frozen meat for last year (1890) was 1,562,647 carcasses, and we are awaiting with interest the next census of the sheep department, which in a month or two will give us the tally of this year. A more serious objection has lately been raised to the extensive slaughter of maiden ewe lambs for export. The finest of these are being regularly slaughtered, and it is feared, and not without reason, that the quality of our flocks must ultimately deteriorate unless a check be put upon the practice. The difficulty is to find a check; for the growers are tempted by high prices, which they are afraid to refuse for fear of the market price subsiding to a lower level.

"The estimates for this year promise a further increase. It is calculated that the North Island will send away 1,225,000 carcasses, and the South Island 928,000; altogether 2,153,000, or 600,000 more than were actually sent away in 1890. To provide for this increase a number of large cargo steamers have been added to the commercial fleet of the colony, and their principal mission will be to carry frozen meat, passengers being made a secondary consideration.

"Mention of these steamers reminds me that if the colony has spared no pains to make the frozen meat trade a success, the frozen meat in its turn has done great things for the colony. It has paid the overdraft on many an encumbered sheep run, and rescued thousands of sheep farmers from the insolvency which inflated prices and extravagant living had rendered apparently inevitable. It has provided the colony with two magnificent lines of steamships running direct to London, vessels of 4,000 and 5,000 tons, fitted up with the electric light and every other luxury of shipboard, and keeping a table which, thanks to the freezing chamber, has surpassed that of any other line in the world. These fine boats have brought crowds of tourists, and have done more, by this and other means, to make the colony known to the world and to remove unjust prejudices against it than any other agency that could be named."

GIVE HIM A CHANCE.

If there ever was a time, we take it, when the ice dealer was tempted to imitate the example of the late Commodore Vanderbilt to get mad and cry out in his wrath, "The public be d—blessed," it is about this time. Naturally, as a *quasi*-public servant, somewhat after the manner of the "gas man," or the water company, the ice dealer expects always a certain amount of complaint. From the first of May until the end of September, if a sensitive man, he worries himself over cries of short weights, impure ice, irregular delivery, and more than all, over charges of extortionate prices; yet in this year of grace, the summer of 1891, with ice from thirty to fifty per cent cheaper than a year ago, the same complaints are rung in his ears by individuals, who are aided and abetted by the daily press, as well as by every trade paper whose patrons may be, from the nature of their business, specially denominated as ice consumers.

Now, while it may be possible that in certain localities there may be dealers who have endeavored to get an unreasonable price for their crop, such instances are rare. Ice, like any other product in general use, is regulated by the great law of supply and demand. During the season of 1890 the price of ice was high—there is no denying that; but the reason was plain. In all the great fields of the country the cuts for 1889 and 1890 were unusually light—short by thousands of tons. The price during the summer of 1890 went up as naturally as darkness follows the day. The season of 1891 was much more favorable than the previous year, and although not up to the average, the cut was large enough to supply all reasonable demands—that is, the demands of the average summer season. As a consequence, the rates this year are substantially the average of prices one year with another, taking the prices of a dozen years.

The ice dealer is very much like "the butcher, the baker and the candlestick maker"—he tries to take care of his own. It will be observed, in the every-day experience of men, that though the "butchers' advocate" howls about the "ice monopolist," and "a repetition of last year's swindling"—by the ice dealer—he nevertheless very frequently takes advantage of a rise of one or two cents in cattle on the hoof in the stock yards, to put from three to five cents on top of his retail prices, and quite as frequently forgets to pull down his own prices until long after cattle have lost their slight rise at the stock yards; and, further, to paraphrase the thought of a "butchers' advocate" it is *not* strange that when his prices do drop it should be "simultaneously with the appearance of a rival in the field."

It is not unlikely that the aforesaid "butchers' advocate," and the public as well, would be satisfied if prices were merely nominal. Growling at the "ice man" is a disease chronic, beyond the reach of any practicable remedy. It has its origin in a very crude notion of how ice is harvested, stored or delivered to the ultimate consumer—a system which the chronic who understands it is careful not to explain. The average consumer thinks that as nature "does all the work," ice should cost nothing, and, therefore, should be as cheap as all things that "cost nothing." The interest on investments in storehouses; on royalties and other cutting rights expenses; on machinery; the labor cost of storing; freights to the city of consumption, storage there and wastage; cost of delivery in labor, purchase and maintenance of wagons and horses; cost of keeping accounts and losses by bad accounts—all these things are apart from the consumer's reckoning when he figures what ice "ought" to cost him, washed and cleaned, delivered in his ice box located on the 'steenth floor "rear," in fifteen-pound lots six times a week.

There are, in fact, few lines of business, in those states where the ice supply is made by nature, which are subject to greater uncertainties than that of the dealer in natural ice. The frequency of open winters when no crop can be made, reducing his investment on buildings to the value of a poor assortment of second-hand lumber; mild summers following good cutting seasons, which in the fall leave him with a large part of his crop still on hand, a proportion of which will surely be lost, even

under the most favorable auspices; or a long, hot summer when his stock is retailed *ad lib.* "by the season"; fire risks, entailing high insurance premiums, for, paradoxical as it may seem, ice houses are classed as "extra hazardous" risks, which when burned are almost invariably total losses; and many other contingencies which are much more in the nature of uncertainties than obtain in ordinary lines of trade; while besides all these, there are in the air mutterings of a demand for "municipal control" of the "ice man"; for the exaction of licenses for delivery wagons, for inspection of stock to smell out alleged impurities, and even for the "regulation" of his prices by the "city council." Yet in spite of all this, the ice dealer is expected to look happy, to be good-natured, to contribute to all charities, to make a living and be happy, with ice at "one-third last year's prices," whether the mercury in June is at 60 or 90 degs., and that, too, whether he sells "by the season—delivered four times a week, if necessary"—or at twenty-five cents per hundredweight!

Verily, the ice man's share of "the earth" promises to be small; with his reward "coming," in a land where the ice, if any, must be made by a "machine."

ANSWERS TO CORRESPONDENTS.

PRESERVATION OF MEAT—CHAMBERLAND FILTER—ICE MACHINE OF THE FUTURE—REFRIGERATING MIXTURE—LATENT HEAT OF CARBONIC ACID.

[This department of ICE AND REFRIGERATION will be conducted for the benefit of the trade generally, as well as individuals, and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

To the Editor: We are aware that refrigeration properly conducted will preserve meat in a fresh condition, but would like to know if there are not also some chemical processes employed which accomplish practically the same thing. P. E. G.

Answer.—We do not know of any such processes being carried on to any extent practically. The treatment of meat by vapors, bisulphide of carbon, chloroform and other substances, has been found to accomplish the object in a great measure, but not without tainting the meat with some peculiar flavor, it would seem. Other pickles, which have been recommended for the same purpose, are subject to more serious objections as regards their influence on the taste and flavor of the meat.

To the Editor: Could water filtered through a so-called Chamberland filter be used to make transparent ice free from bacteria, equal to distilled water being used? F. R.

Answer.—If the filter is constructed in accordance with the precepts of Chamberland, it will produce water free from bacteria. We are unable to say if it would make transparent ice, but are inclined to doubt this; at any rate, we do not think that a filtration of this kind would supersede distilling in a large ice making plant.

To the Editor: In your last issue is described what is called the "ice machine of the future." Is there anything like that being constructed anywhere at present, and, if so, where? C. F.

Answer.—From what we know of the matter, and take from the contents of the article in question, no machine of this kind has been executed, it being merely an exposition of the theoretical possibilities of a proposed system.

To the Editor: Can you give us a recipe for making cold, without machinery and without using ice? We understand that certain chemicals will do it. H. SCH.

Answer.—A mixture of one part of sal. ammonia, one part of saltpeter and one water, will reduce its temperature from +40 deg. down to —40 deg. F. A mixture of one part nitrate of soda and four parts of water will be reduced in temperature from 55 deg. down to 23 deg. F. A mixture of eight parts of Glauber salts and five parts of concentrated sulphuric acid is reduced in temperature from +50 deg. to 0 deg. F. Similar differences are obtained by starting from different initial temperatures.

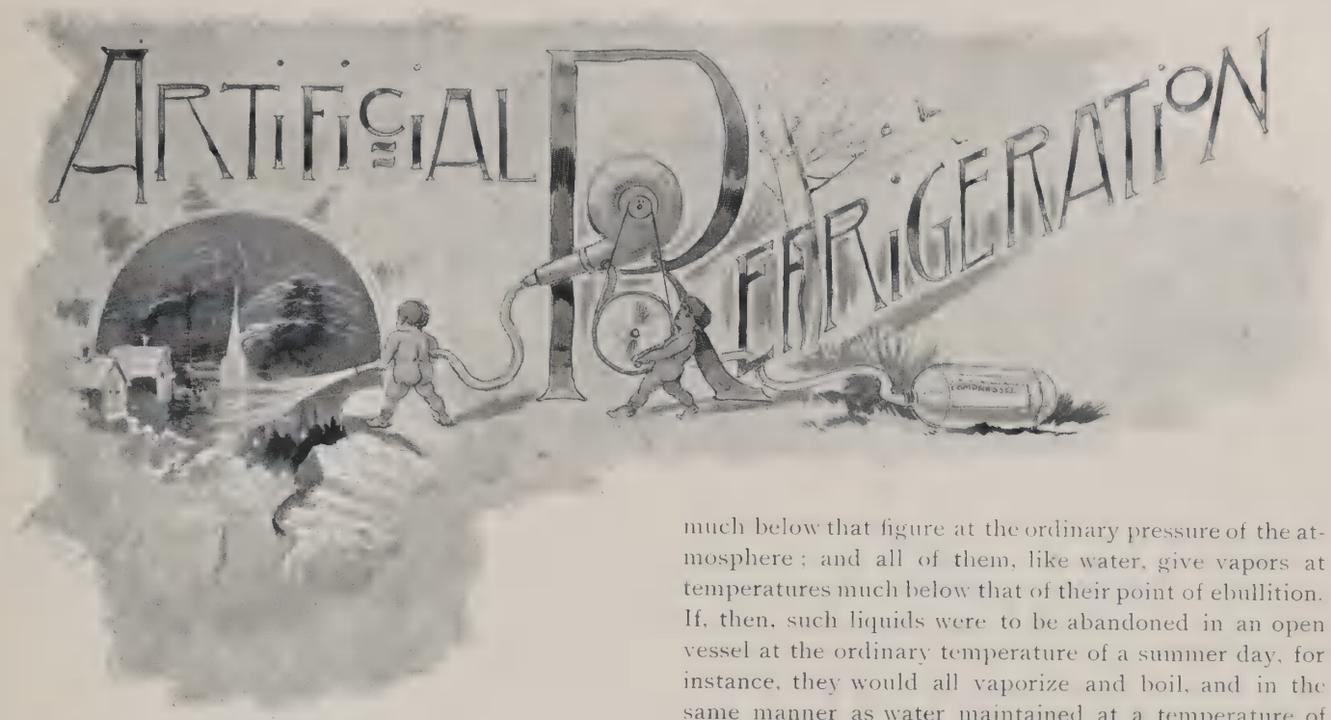
To the Editor: What is the latent heat of vaporization of carbonic dioxide, as compared with that of anhydrous ammonia? S. K.

Answer.—According to Faure, and for equal weight, the latent heat of carbonic dioxide, in its solid state, is about one-half of that of anhydrous ammonia. In the liquid state it would therefore be still less.

THE *American Exporter*, in a recent issue, calls the attention of exporters, particularly shippers, to the Spanish-American states, to the desirability, not to say necessity, of acquiring a thorough and reliable knowledge of the business standing of their correspondents and consignees there. Appreciating the desire of American manufacturers to introduce their goods into new territory, and knowing further that the attention of Americans has been specially directed to the Spanish-American states by Secretary Blaine's successful negotiation of a reciprocity treaty with Brazil and Spain, and his purpose to negotiate similar treaties with other states of Central and South America, adventurers by scores have put in an appearance in all the great seaport towns of those states, posing as importers, manufacturers' agents, etc. Their actual capital is, in the main, a large and varied assortment of "brass" and impudence, which is turned to good account in the solicitation of consignments of goods on credit; and the ingenuity of their varied efforts is as remarkable as their actual business responsibility is small and insignificant. Would-be exporters will, on inquiry at proper sources, experience no difficulty in finding reliable correspondents and agents in all those states, to whom credit may be as safely extended as to dealers in the United States; but it is in general safe to say that the most solicitous of these foreign importers (?) are those least entitled to such confidence. The advantages of cash are as well known to reputable dealers in the antipodes as to those of our own country, and as a rule their purchases are for cash; so that while it is not true that credit is never asked by reputable houses, it is less frequent than cash transactions. The application for it is, then, to be treated carefully, and granted only after the responsibility of the applicant is fully investigated.

THE season thus far has been far from favorable to the ice dealer, but he can now take heart. W. T. Foster, a St. Joe, Mo., weather prophet, June 20, predicted a season of excessive heat about August 1 to 10, followed by rains; so that the average man is sure to be roasted or boiled, unless he patronizes the "ice man."

THE phenomenon of latent heat was first inquired into by Dr. Black, of Scotland, nearly 130 years ago. His attention was directed to the subject by observing that a mixture of ice and water, though absorbing a measurable amount of heat, did not rise in temperature until all the ice had disappeared.



[*Written for* ICE AND REFRIGERATION.]

ARTIFICIAL REFRIGERATION.

A CHRONOLOGICAL STUDY OF ITS DEVELOPMENT—ITS IMPORTANCE, ITS APPLICATIONS, ITS FUTURE.

BY AUGUSTE J. ROSSI, B. S., C. E.

[*Continued from July Issue, page 13.*]

SUCCESSIVE DISCOVERIES UP TO THE PRESENT CENTURY, WHICH HAVE LED TO MODERN APPLICATION.

Air, as is well known, is capable of charging itself with certain quantities of moisture, or watery vapors, quantities which vary with its temperature. If air, dry or not, saturated with moisture, be passed by some artificial or natural means over the surface or through water contained in vessels properly insulated, it will necessarily charge itself with moisture to the degree corresponding to its possible saturation in the given circumstances, thus promoting to a greater degree still the spontaneous evaporation of the water, and to such a degree that, with proper conditions of dryness or saturation of the air, the temperature of the liquid will fall nearly or to that of the freezing point. In such a case, the greater the velocity of the air, the drier it will be, and evidently more effective will be its action for obtaining the desired results. On this observation, as we will have occasion to mention, has been based an early method of cooling liquids. In short, the phenomenon of the spontaneous evaporation of water has been the first one to attract attention, and the first one of which the consideration has produced some practical results. They may be called the first attempts at artificial refrigeration.

When it is said that a liquid is more volatile than water, it is meant that its boiling point is below that of water; and it is important to remark that the word ebullition, "boiling," need not convey necessarily the idea of heat, as it is commonly understood, heat and cold, as we have seen, being but relative expressions. Thus ether boils at 90 deg. F. (about); gasoline at 60 deg. F.; other light products of petroleum at 40 deg. F., other liquids at 32 deg. F., and many liquids at temperatures much below that figure at the ordinary pressure of the atmosphere; and all of them, like water, give vapors at temperatures much below that of their point of ebullition. If, then, such liquids were to be abandoned in an open vessel at the ordinary temperature of a summer day, for instance, they would all vaporize and boil, and in the same manner as water maintained at a temperature of 212 deg. F., that of its boiling point, whatever was the source of heat applied to the vessel containing it; in the same manner would the temperatures of these liquids remain at 90 deg. F., 60 deg. F., 40 deg. F., 32 deg. F., or below, as the case might be, according to each liquid, as long as there would be liquid left to evaporate; provided, that the source of heat, the surrounding air of summer, in this case, could furnish *all* the heat necessary for this change of state from liquid to gas.

But, as was the case for water in the India process for making ice, if these liquids are left to evaporate in such a manner that the air or surrounding objects cannot any more supply the heat necessary for the transformation to gas—for instance, if they are placed in open vessels well insulated, or if the air and surrounding objects are not adequate to furnish that heat, or can furnish it but partially—they will have to borrow the "latent heat" necessary for their ebullition from their own mass, as has been the case for water, and their temperature will fall considerably below that of their boiling point, whatever the latter may be, 90 deg. F., 60 deg., 40 deg. or below the freezing point of water. Were such liquids obtainable at such prices that we could afford industrially to let their vapors be lost in the air, as we did for water vapors, we would have then a powerful means of obtaining very low temperatures artificially.

All that we have said about water would apply equally well, but with an intensified effect, to these more volatile liquids, and the rapid passage of a current of air over and through their mass, promoting their spontaneous evaporation by removing the vapors given off, would cause a great depression of temperature in the liquid. In this case the cooled liquid, were the temperature obtained sufficiently low for such purpose (as is the case with many of them), would be made available by using a judicious proportion of it for the actual freezing of water by indirect contact through the sides of proper vessels dipped in the liquid and containing the water to be frozen.

These observations, based on the simplest phenomena of nature, afford us, in fact, another method of artificial refrigeration. Whenever the liquid thus evaporated

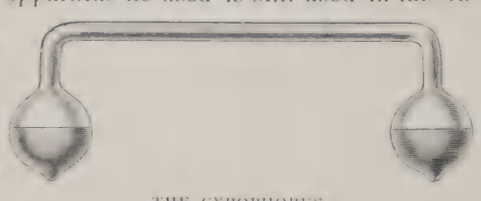
shall be cheap, or whenever its vapors carried away by the passage of a current of air through or over it, or both, shall be susceptible of being cheaply collected, separated and condensed to their original liquid state, to be used over again, such method will prove economical and really industrial, at least within certain limits of production. We will have occasion to show a practical application of this principle to machines of small capacities for the production of ice; but our object for the present is to make a sort of chronological examination, as rapid as possible, of such physical laws which, successively better understood and applied, has brought artificial refrigeration to the prominent place it has acquired in our days.

SOME EARLY EXPERIMENTS.

It was discovered early that in the same manner as spontaneous evaporation was considerably promoted, and consequently the cooling effect produced much increased whenever the vapors formed were removed from the surface of the liquid (water, for instance) by a current of air that, were the pressure of the atmosphere which offers a resistance to the expansion of these vapors partly or nearly completely relieved, as well as the vapors given off removed, a greater cooling effect still was obtained.

In 1810, Prof. Leslie, of Edinburgh, in a remarkable experiment, easily repeated, showed that if the vapors given off under a reduced pressure by a volatile liquid, such as water contained in a vessel placed under the reservoir of an air pump exhausting mechanically the air from a reservoir, were absorbed as fast as formed by a suitable substance, such in this case as concentrated sulphuric acid placed in a vessel close to the water vessel, the water entered almost immediately into a violent ebullition, and in a very short time solidified into a mass of ice. This interesting experiment, a curiosity of the lecture room for a long time, has led, with slight modifications of the apparatus, to industrial applications for the production of small quantities of ice for family use in warm climates in our days, and, with more radical changes in the contrivances used, has even formed the basis of a system of production of ice and cold on a large scale and in any quantity.

Wallaston showed in a beautiful experiment, that water could be made to freeze also by its own evaporation, were the vapors given off condensed as fast as formed. The apparatus he used is still used in laboratories under the name of cyrophorus. It consists of a straight glass tube bent at right angles at each extremity, the ends of the small branch tubes having a large bulb, as seen in the figure. Water having been introduced in the tube, one of the bulbs being unsealed for that purpose, so as to fill about three-fourths of one, in the other bulb the water is heated, and when the vapors or steam given off have driven out the air from the tube, the empty bulb is sealed at the lamp. The apparatus contains then water and vapors of water, but no air. All the water is then caused to pass into one of the bulbs and, plunging the empty bulb into a freezing mixture, the other bulb containing the water begins to give vapors, which being condensed as fast as formed in the cooled empty bulb, a corresponding quantity of water evaporates from the other bulb to supply the place of the condensed vapor. This condensation and evaporation proceed so rapidly that in a short time the water cools down to below 32 deg. F., and a solid mass of ice is left in the other bulb.



THE CYROPHORUS.

The heat necessary for the evaporation has been furnished in this case, as in the above, at the expense of the liquid itself, the outside source of heat, the air, not being adequate to supply it, the vapors given off being removed as fast as formed by being condensed in the cold bulb.

It had been observed and had been known for many years back, that by mixing together proper proportions of common salt and snow, or ice broken in small pieces, a depression of the temperature down to 0 deg. F. could readily be attained; in fact, Fahrenheit adopted for the zero of his thermometer the temperature obtained by the mixture of specific quantities of pulverized ice and common salt. This simple method of producing artificially an intense cold found early a somewhat industrial application in the making of frozen blocks of creams, and was applied either for laboratory experiments or on a much larger scale, for many purposes, whenever a low temperature was required. In our days it has been even recognized as an industrial method of refrigeration. Its main drawback, at any rate, lies in the use of "ice," the very article which artificial refrigeration intends to supply.

Other substances besides common salt possess this same property of producing cold by being mixed with snow or pulverized ice. For instance, a mixture of common salt 2, sal. ammonia 1, and snow or pulverized ice 5 parts in weight, will lower the temperature of the mixture from any temperature to —12 deg. F., 12 deg. below zero F.; 10 parts of common salt, 5 of sal. ammonia, 5 of saltpeter and 24 parts snow or pulverized ice will depress the temperature of the mixture from any point to —18 deg. F., 18 deg. below zero F.; common salt 5 parts, sal. ammonia 5, snow 12 parts will lower it from any temperature to —25 deg. F., 25 deg. below zero F. A step farther in this direction was made when it was observed that certain substances, such as sal. ammonia 5, saltpeter 5, dissolved in 16 parts of water in weight, would cause the temperature of the solution to fall 40 deg. F.—from 50 deg. to 10 deg. F.—without the use of any ice or snow (Berzelius). A mixture of 1 part of nitrate of ammonia, 1 part of carbonate of soda and 1 part of water, or equal parts of water and nitrate of ammonia in weight, will cause a fall of temperature from 50 deg. F. to —7 deg. F., 7 deg. below zero F., a range of 57 deg. F.; 3 parts of phosphate of soda, 2 nitrate of ammonia, and a little more than 1 part in weight of water, will sink the temperature of the mixture from 50 deg. F. to —22 deg. F., 22 deg. below zero F., or a range of 72 deg. F. If the water and the different substances are taken at a temperature above 50 deg. F., the sinking of the temperature may be still larger. These depressions are to be considered as applying only to the solution itself, on the supposition that it draws no heat from the substances in contact with it, such as air, etc.; that is, that the vessel containing them is in some manner insulated, allowance being made also for whatever heat may be furnished by the vessel itself. Such solution could evidently be used for cooling water, at least, and, with proper care

and in certain conditions and proportions of mixture and water to cool, even to the point of freezing it solid. These observations led only for many years to the compounding of frigorific mixtures for certain purposes of experiment, but they have received, of late, an industrial application, as we will have occasion to mention, in the making of as large quantities of ice as fifty and seventy-five pounds per hour in special machines, and it has been claimed that such system could be used for any purpose of refrigeration. The solutions of the salts, after they have produced their cooling action by their being dissolved in water, have to be evaporated to dryness, so as to obtain the salts in the solid state for a fresh operation, but it is not our purpose to discuss the value, nor do we wish to claim the superiority or economy of this or any other system: we intend only to mention it, among others, as another step in the production of artificial cold, different from all the preceding methods, and, as we will see, also from the following. The preceding observations of the properties of certain salts to depress the temperature by their being dissolved in water date mostly from the early beginning of this century, and many years elapsed before any serious applications were made of this action.

(TO BE CONTINUED.)

A CORRESPONDENT of the Omaha *Bee* suggests that there is a great scheme running loose at Hastings or thereabouts that needs lassooing—by a moneyed man, of course. He says: "A safe and paying investment of capital would be found in turning a natural basin of 230 acres (near Hastings) into an artificial lake, by the aid of a running stream traversing it. To purchase the land and complete improvements, would demand an outlay of $30,000. At least $5,000 could be realized from boat and pleasure privileges, while the ice crop alone would sell for $15,000." Sorry he didn't mention it "to a feller" quietly! As it is, the "tip" has no doubt brought a rush of capital to Hastings, and spoiled the deal for slow coaches!

THEY WILL KICK.



Lady—"What! ice so plenty this year, and yet higher-priced than ever."

Ice Man—"Oh, yes, mum. The cutting of ice was very expensive, mum; and don't yez see there was so much more to cut?" —*Judge.*

[*Written for* ICE AND REFRIGERATION.]

THE ECONOMICS OF REFRIGERATION.

BY J. E. SIEBEL, DIRECTOR ZYMOTECHNIC INSTITUTE, CHICAGO.



WHILE refrigeration and the various means for producing the same have ceased to be a luxury, but have become a daily necessity, the question as to their most economic employment is one of primary importance. Moreover, this question is pre-eminently a practical one: and for this reason it is intended to discuss the same in a manner in which it is deemed to be most likely to interest the practical mind. To do this it seemed desirable to confine the discussion to one special class of machine at a time, and, therefore, the following remarks refer more especially to the anhydrous ammonia machine with brine circulation. Its general mode of operation is sufficiently well known, and, therefore, needs no further explanation.

The cold or refrigeration produced by such a machine is due to two sources. In the first place, the liquid ammonia changes its physical condition: from a liquid it becomes a gas; the velocity of its molecules is increased and a corresponding amount of heat is absorbed without increasing the sensible temperature. The amount of heat absorbed in this manner is the latent heat of vaporization of ammonia, and its amount varies with the temperature at which the volatilization takes place. At the temperature of 25 deg. F., at or about which the volatilization takes place in the practical working of most refrigerating machines, the latent heat of volatilization of anhydrous ammonia equals 540 calories. That is, in other words, the refrigeration produced by the vaporization of one pound of ammonia under these circumstances is capable of reducing the temperature of 540 pounds of water 1 deg. F. If ammonia is vaporized (always kept saturated) at a lower temperature, the latent heat of vaporization is greater; and for this reason it might be argued that the most economical way of running refrigerating apparatus would be in keeping the temperature in the vaporizer (*i. e.*, in the coils in the refrigerator) as low as practicable. Quite the reverse, however, is the case: for evaporating at lower temperature means also evaporating at a correspondingly lower pressure, and the lower the pressure in the refrigerator coils, the smaller is the amount of useful work done by the vaporizing gas in helping to propel the compressor piston.

Moreover, whatever assistance is given by the vaporizing ammonia in moving the compressor piston, an amount of refrigeration equivalent to the work done hereby is simultaneously produced. And this constitutes the above-mentioned second source of refrigeration in an ammonia plant. Practically, both sources of refrigeration are in a measure complementary to each other; if one grows greater the other grows smaller, and *vice versa*. However, as with the growth of the refrigeration due to the second source, the actual compressor work is lessened (since both the difference in pressure on both

sides of the compressor piston is less: and, also, the volume of vapor to be compressed is smaller), it follows that the capacity of a machine for refrigeration, other circumstances being equal, increases with the temperature in the brine or refrigerator tank. In other words, the latter should be maintained as high as compatible with the work required to be done. Sometimes we are called upon to contemplate the low temperature of the outgoing brine as evidence of the efficiency of a machine; but if this temperature is lower than is necessary to convey the desired refrigeration to the rooms to be refrigerated, the plant is not managed in an economical manner.

These points may be more readily understood by many by referring to a practical example. Let us, therefore, take the case of two machines made and working exactly alike, making the same number of revolutions, and, therefore, taking in the same number of cubic feet of ammonia vapor from refrigerator coil in the brine tank. Let the brine be kept at different temperatures, however, in both cases, so that in the one the pressure of ammonia in the coil is 55.2 pounds, and in the other 41.9 pounds per square inch. What will be the refrigeration produced in both cases? In the case where the ammonia pressure in the vaporizer is 55.2 pounds, the vapor contains five cubic feet per pound, and its latent heat is 540. Taking the amount of vapor taken into the compressor per hour at 2,580 cubic feet, the work done by the expanding gas in compressor is:

$$\frac{2{,}580\times 55.2\times 144}{1{,}980{,}000} = 10.36 \text{ horse power}$$

and its equivalent amount of refrigeration

$$10.36\times 2{,}565 = 26{,}573 \text{ calories.}$$

The refrigeration due to the vaporization of the ammonia amounts to

$$\frac{2{,}580\times 540}{5} = 278{,}640 \text{ calories.}$$

Total refrigeration, 305,213 calories.

In the other case, in which the ammonia pressure in vaporizer is 41.9 pounds per square inch, the vapor contains 6.66 cubic feet per pound, and its latent heat is 547. Referring to the same compressor capacity as before, the amount of work done by the expanding gas in compressor is:

$$\frac{2{,}580 \times 41.9 \times 144}{1{,}980{,}000} = 7.86 \text{ horse power,}$$

and its equivalent amount of refrigeration

$$7.86 \times 2{,}565 = 26{,}573 \text{ calories.}$$

The refrigeration due to the vaporization of the ammonia amounts to

$$\frac{2{,}580 \times 547}{6.66} = 211{,}990$$

Total refrigeration, - - 232,160 calories.

These figures show that with the same plant and, as we shall see further on, with very little increase in steam power and condensing water, we have increased the refrigeration over thirty per cent by simply working at a higher temperature in brine tank.

Besides, by the pressure and volume of the incoming gas the work required of the compressor is also greatly affected by the pressure in the condenser coils, and increases with the latter. The pressure in the condenser coils in turn depends on the temperature of the condenser water, wherefore it follows that the cooler and the more ample the supply of the latter, the more easy will be the work of the compressor. In many cases the temperature and supply are fixed quantities, in other cases it may become a question as to whether an increased supply of condensing water pays for the increased expense of providing the same. The question may also present itself, whether under given circumstances it would be advisable to bore for a cooler supply of condensing water. In dealing with this and other questions of this kind, it must be considered that in the same way as an increase in the temperature of the outgoing brine, so a decrease in the temperature of the outgoing condenser water has a two-fold advantage. For by reducing the pressure in the condenser it not only lessens the actual work done by the compressor, but it also lessens the production of heat due to the working of the compressor which would otherwise require an additional amount of cooling water, and in an increased ratio.

These observations and conclusions, as well as the above calculations, are forcibly sustained by the subjoined tables, showing the actual results obtained by Schrœter, in working an anhydrous ammonia machine under different conditions:

Number of Experiment.	1	2	3
STEAM ENGINE.			
Feed water per hour in gals.	48.3	49	64
Temperature of feed water, F.	71	70	84
Mean pressure (indicator), pounds per square inch	26.2	26.3	33.5
Revolutions per minute	44.91	45.10	44.97
Work done in horse powers	18.88	18.99	24.06
COMPRESSOR.			
Work done by compressor in horse powers	15.31	14.98	21.54
Pressure in condenser coils	135.2	131.2	199.2
Pressure in refrigerator coils	55.2	41.89	41.9
REFRIGERATOR.			
Temperature of incoming brine	42.8	28.37	28.35
Temperature of outgoing brine	37.2	22.97	22.99
Brine circulating per hour in lbs.	65,051	50,364	43,115
Specific gravity of brine	1.250	1.250	1.247
Specific heat of brine	0.850	0.846	0.845
Heat absorbed in refrigerator in calories	310,335	230,657	195,920
CONDENSER.			
Temperat'e of condenser water F.	49.21	49.17	49.42
Temperature of outgoing condenser water	67.57	67.34	95.60
Amount of condenser water per hour, pounds	19,338	15,041	5,328
Heat absorbed in condenser in calories	355,950	273,891	248,680

The results tabulated in columns 1 and 2 of this table readily show the effect of different temperatures in the brine tank. While in both experiments the labor of the compressor is nearly the same, the refrigeration in case No. 1 is carried on between the temperatures in the brine tank of 42.8 and 37.2 deg., while in case No. 2 the refrigeration is carried on between the temperatures 28.37 and 22.97 deg. The result is most marked, for the refrigeration obtained in these cases is, in case No. 1, 310,335 calories, and, in case No. 2, 230,657 calories refrigeration per hour. The cooling or condensing water used in both cases is practically the same per unit of refrigeration produced.

Again, in comparing the results recorded in columns 2 and 3, the influence of different amounts of condensing water is at once apparent. In these two cases the temperature of the incoming and outgoing brine is about the same. The work done by the compressor is much greater in No. 3 than in No. 2, yet the actual refrigeration in No. 3 is only 195,920 calories, against 230,657 in No. 2. This great difference is simply due to the different amount of condenser water used in both cases, being 15,041 pounds in case No. 2, against 5,328 pounds in No. 3. Of para-

mount effect, on the capacity of refrigerating machinery, is the initial temperature of the condensing, or cooling, water, as both its own consumption, as well as the consumption of labor of the compressor, is reduced by any reduction in its temperature. The mentioned relations are shown still clearer in the following table, in which the different qualities are reduced to 1,000 units refrigeration:

	1	2	3
Horse power produced by engine per 1,000 units refrigeration....	0.060	0.082	0.123
Horse power used in compressor per 1,000 units refrigeration....	0.049	0.065	0.109
Pounds of condensing water used per 1,000 units refrigeration....	62	65	27

While other lessons may be learned from the above figures, those referred to are of the greatest practical importance for the operators of refrigerating machines. They also show that in testing a machine for capacity, the temperature in the brine tank should be held as high as possible; that is, in all cases where the conditions as to use of steam and condensing water are given, as if, for instance, the maximum capacity of a plant were to be determined, independent of the amount of steam and water used, the case would be different.

THE MODERN FRUIT TRADE.

Not the least of the blessings that have come to the great mass of the people of this country during the past few years by means of the inventive genius that produced the refrigerator car and cold storage warehouse is the abundance of cheap and good fruit at all seasons of the year. All the world now contributes of its stores to minister to the appetites of all its people, the prohibitive force of climate and distance that formerly obtained, having been overcome by steam in conjunction with scientific refrigeration. Thanks to the skillful combination of the arts of transportation, the reign of the strawberry, for example, has been extended in the northern markets from April to August. Instead of the brief fortnight or so during which it was formerly in market, the period now entends from the first picking in Florida to the last gleaning in Wisconsin. All strawberries are good, as the Kentucky man said of whisky, but some are better than others; yet on the whole, from the first pickings to the last gleanings the voice of the people acclaims accord with the burst of the ancient worthy, who said of the strawberry, "Doubtless God could have made a better berry, but doubtless God never did." The strawberry is food, drink, medicine, nectar and perfume, all in one. It is pleasant to think that it is so abundant that everybody can enjoy it.

Thanks to the same agency the vast stores of other fruits of the far south and the still farther west no longer rot where they grow, but from early spring until snow falls in the north grace the tables of rich and poor alike, bringing health and pleasure to thousands. Only a few years ago the pineapple, a name that always brings with it a breeze from the tropics, could be tasted only by the well-to-do in this world's goods, yet, a few days ago, the New York fruit market report said, "The pineapple market is stocked to overflowing with fine fruit, the most conspicuous of which are the shipments from Indian river, Fla.," which though small sold for only a shilling! From the same source we learn that "the first car load of California fruit to reach New York city this season brought 1,309 packages of Black Tartarian, Governor Woods and Rockport cherries. The car grossed for $33,000, and netted $2,300, a handsome profit for the shippers." Since then the markets of the east, not only metropolitan, but rural, have been stocked with white and black cherries, offered at prices but little higher than those formerly asked for the native grown fruit—when there was a crop to offer.

Thus in the south and in California the refrigerator car has been the means, not only of developing the older orchards, but of bringing under cultivation thousands of new acres, causing the investment of millions of dollars in irrigation works, and giving employment to thousands of working people. It is not all sunshine with the shipper, however, as occasional losses occur, even in these days, and recently two car loads of California oranges in transit east became overheated when crossing the Arizona deserts, and were spoiled. This, however, is a rare cause of loss to the shipper.

In like manner, early in June, the watermelon season began with the shipments received from Georgia: and agents of the great metropolitan commission houses who have covered the watermelon district of Georgia and South Carolina, the greatest producers in the world, say the acreage is greater than ever. These shippers have the advantage of from six to eight weeks over their northern competitors, and during that time manage to dispose of probably 4,000,000 or 5,000,000 melons. The earliest shipments (Floridas) brought this season $1 each for melons weighing in the neighborhood of fifteen pounds.

The melon is not shipped usually in refrigerator cars, but nevertheless the business is indirectly the result of that system which has made fruit as much a necessity of modern life as is beef or the potato.

By means of the cold storage houses the season of the grape, which rivals the strawberry in the affections of the people, has been extended far into the winter. Grapes properly packed in boxes so that the covers do not crush the fruit can be kept indefinitely at a temperature of 34 deg., practically without loss, a record of one well conducted cold storage house which we have in mind, showing that 350 baskets of grapes properly packed, put in storage in October, came out in February with the loss of only five baskets out of the entire lot.

By and by, too, buyers, when they have discovered the difference, will accept from their grocers only dried fruits which have been preserved by the cold storage system, and will refuse the dirty, moldy, wormy fruit they now buy during a large part of the season. By cold storage the fruit is preserved from fermentation, remains sweet, and is free from insect life which permeates it during the summer months. It may become a luxury one day, whereas, as now preserved (?) and marketed it is a mere makeshift, consumed only by those who can afford no better form of "preserves" for "sauce" on the luncheon table.

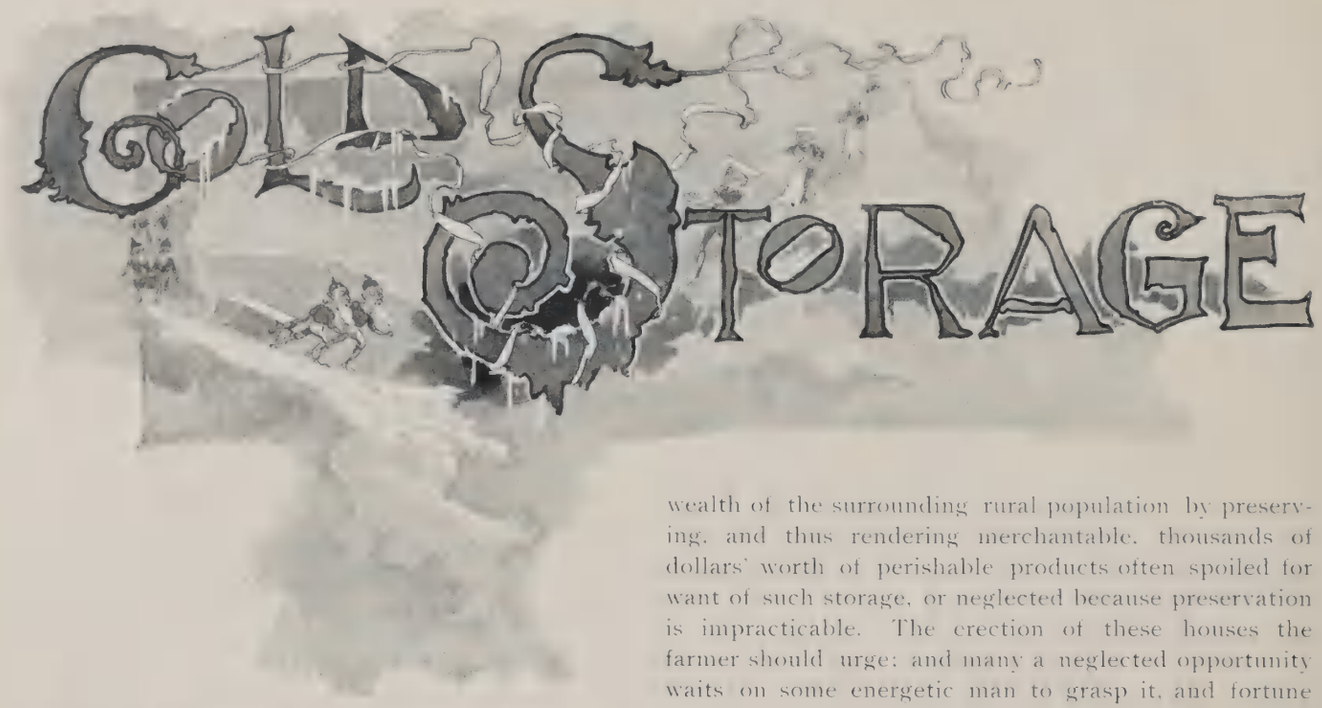
THEY WANT THE EARTH.

Customer—You didn't leave any ice here yesterday.

Ice Man—Yes, I did. Didn't you notice a small damp spot on the sidewalk?

Customer—Yes.

Ice Man—Well, that was your ice. It melted before I could get it into the house. —*Munsey's Weekly.*



COLD STORAGE AND THE FARM.

When he contemplates the enormous mass of dirty, salvey, bad-smelling, and still worse tasting butter (so called) that pours from the farms into every rural "general store" and thence into the commission houses of the great metropolitan markets, to be sold eventually as "soap grease," the economist might stand aghast at the enormous amount of worse than wasted energy spent in the production of such fearful "stuff." In spite of that very best evidence of failure: an insufficient price realized for the product, thousands of farmers' wives will persist in ruining good cream to earn "pin money," by working it into butter, though provided with not a single appliance of the art save a dasher churn and a butter paddle, and surrounded by no conditions for successful butter making, during at least five months of the year, and those the very months when the greatest amount of "soap grease" is made because the pasturage is then at its best.

Successful butter making in hot weather depends on the possession of the conveniences—the necessities—of plenty of ice and a cold storage room—conditions seldom found outside the modern creamery. Churning should be done with cream at 58 to 60 degrees in hot weather, and when the butter comes into little pellets about the size of a buckshot the process then requires an abundance of pure cold water, the butter at length being stored in the cold room awaiting shipment. These are conditions but rarely attained on the farm, unprovided with ice, and less seldom with even a spring of cold water. How much better, then, would it be for the farmers to aid in the establishment of creameries in their neighborhood—which too many of them discourage, rather than encourage—where the product of their cows can be worked into merchantable butter, than to waste it in the "home-made" article, ruined by storage in a hot, ill-smelling country store, even if it comes sweet and clean from the farm.

In all parts of the country are centers of rural populations, or markets for farm products, of the dairy and poultry yards, where cold storage houses would be not only profitable to their owners, but add immensely to the wealth of the surrounding rural population by preserving, and thus rendering merchantable, thousands of dollars' worth of perishable products often spoiled for want of such storage, or neglected because preservation is impracticable. The erection of these houses the farmer should urge; and many a neglected opportunity waits on some energetic man to grasp it, and fortune also.

Many farmers, says an expert poulterer, spoil eggs by feeding their fowls tainted meat, the rancid refuse of the kitchen, as the easiest way to get rid of it. It is a pretty well recognized fact now, that carrion, onions, musty food fed to hens, filthy houses, nests, etc., will cause eggs to be tainted; and the systematic way in which eggs are now handled in the great markets causes the loss to the shipper of thousands of dozens of such produce, which are rejected as unwholesome, or, at least, undesirable, for the changing of dead meat into eggs does not wholly purify it though its form be changed. Heat is, however, a far greater enemy of the egg dealer, thousands of eggs, improperly cared for, becoming unfit for use in warm weather before they can be sold in the cities. Twenty-four hours in a high temperature will start the process of decomposition, and spoil a perfect egg, while a tainted egg spoils frequently in half that length of time in the same temperature. Eggs should be stored in clean rooms, at a temperature of 36 deg. F., and turned occasionally. Kept in this way they should hold their flavor and freshness for any reasonable length of time, giving the owner practical control of the hour of shipment to secure the best prices.

The Colorado Ice & Storage Co., of Denver, Colo., having secured control of the ice interests there, which are placed under the management of Major Sowers, who is supplying artesian ice only, the town seems to be "all torn up," because the Major refuses to furnish ice in ten-pound pieces, delivered daily, at one-half cent per pound! For goodness' sake, what do the people of Denver expect? A daily delivery of ten pounds of ice, washed and laid in the ice box, if made by the wagon stopping at every house on the street, would cost more than five cents for the time of the delivery, man and wagon alone. When a consumer begins to talk about ice, it does seem as though his common sense immediately froze up, like a cake of ice, and became as deaf to the appeals of reason.

——Ice is one of the articles admitted free of duty to Cuba from the United States under the new reciprocity treaty with Spain.

[*Written for* ICE AND REFRIGERATION.]

PRACTICAL COLD STORAGE.

THE STORY OF A PIONEER IN THE BUSINESS—HIS TRIALS AND SUCCESS—THE TRADE IN OMAHA, NEB.

By D. B. Beemer.



THE writer is an old pioneer in the cold storage business, having built my first refrigerator room in the third story of the block on South Water street, Chicago, occupied by H. P. Stanley & Son, before the big fire. I smuggled, or "poached" my plan and ideas from a few minutes' view of the interior of a "freezer" used by Robins, the Fulton market man, in New York, away back in 1869. In its construction I adopted improvements of my own, suggested by what I saw in his room.

The first thing I did with it I froze it full of wild pigeons, bought at fifty cents a dozen off the market in Chicago after a "break" in New York, which forced them down in Chicago. The pigeon "roost" that year was near Sparta, Wis., and all stock for eastern markets going through Chicago, and when New York and other eastern markets "broke" under heavy shipments, the birds naturally stopped at Chicago until that market broke down too. In the faith of and relying on a reaction in the New York markets, I loaded my room with frozen birds and waited till the expected "rise" began, then shipped daily by express soft birds off the street in barrels with a *core of frozen birds instead of a chunk of ice*. By the time the birds got there, the frost was out of the frozen ones, and all sold for fresh killed. I cleared $1,000 in ten days' time in this way before the market broke again.

The next year, 1870, I was much interested in a cold plant in operation in New York, which involved the use of a steam engine in connection with a "blast blower," which was connected with a series of air-tight rooms by air pipes with "cut-off" attachments to each room, through which the air was sucked from any given room that had the valve open at the time—connection with the others being shut off for the time being—and forced out from the "blower" through another pipe leading into and through a set of air pipes immersed in an upright, metal-lined, wooden tank filled with a mass of ice and salt, and back into the room again through another pipe. In this way a circuit was established—the air, drawn from the room by one pipe, to be returned by the other after its passage through the tank of ice and salt. It seemed a practical thing, and I went back to Wisconsin and built rooms in a warehouse there to hold poultry frozen until ready to ship it to eastern markets. I had a poultry ranch there, covering three acres of ground, with feed pens, roosts, slaughter houses, etc. I killed and froze up six car loads that season in December and held them until February, when I loaded in refrigerator cars and went to New York and stored them in a freezer on Water street until the market suited. As all this poultry was hard frozen and boxed air-tight before storing in these rooms, it held itself until ready to ship without the aid of the "blower," so I had no opportunity to test the system further.

The next year, 1871, I came to Omaha and started in the fruit and produce commission trade. I soon saw the necessity of having cold storage for eggs, butter and fruit, and I proceeded to put up a room on the tank system, similar to the "Davis" white cars used on the Michigan Central R. R. at that time, with V-shaped tanks reaching from the floor to the ceiling. And, by the way, that "Davis" car was the *most powerful refrigerator car that ever traveled*. I used, in those times, in the 70's, to take one of those cars out to Wisconsin, Michigan or Pennsylvania, wherever a "pigeon roost" set in, and let it stand on the track while I bought dressed pigeons of the "trappers" and stored them up by the barrel in the car. I had no trouble in freezing up the stock in the car and keeping it that way until I got it filled up, and went to New York with them. Show me a car that is able to do such work to-day!

I experimented with this and other rooms for several years, until I had a storage capacity of several car loads, and held butter, eggs and fruit with varying success; but I always encountered the difficulty of damp air in the rooms. Then it occurred to me that I had better try the old "blower" plan, which I believed would give dry air. So I brought my blower from Wisconsin and set it up in connection with two rooms, one full of eggs, the other full of oranges and lemons. For "power" to run the blower I put a horse-power in the cellar, with a couple of men and ponies to work in "shifts" day and night. The ponies and men soon got worked out and sleepy, however, resulting in constant stoppages of the machinery at intervals. To remedy this I turned out the men and ponies and geared on to a steam engine, which I ran "of nights" myself, to make sure that it did not stop, like the ponies, nor "blow up" through the driver's going to sleep.

Then a new difficulty developed, through pressure of the ice upon the air pipes in the tank. They burst so that water rushed in and stopped the machinery. Then it was a rush to empty the tank, mend the pipes and get it going again. This sort of thing recurring several times, I saw that the upright tank, with its high column of pressure, was "no good." So I had coils of pipe made, similar to "Kingan's" system in an Indianapolis packing house some years ago, and submerged them in flat and shallow tanks resting along the floor, and with these I got through the season—sixty days—until I struck the market I was aiming at. Then I fell back on the floor tank system again, and cleaned out the blower system, with its complications, risks and waste of attendance. I have from that time to this stuck to the Davis tanks and fine feed with salt, which gives more power than any other system using ice, and enables a man to have command of the temperature in a room.

But through years of experiment and study of the business of refrigerating, and building of new rooms, in which I left out those features that proved to be bad in results in previous ones, and adopting new ones suggested by study and necessity, I have at last perfected a system, practically my own,—there is no other like it in the country, east or west.

The question of obtaining dry as well as cold air was the one that longest refused to be solved; but as no

other systems afforded relief. I lay awake nights until I studied out a plan which involved the old philosophical principle of circulating air through cold metal pipes to both cool and condense the moisture from it. I have used it now in my rooms for ten years with uniform success. It is self-acting, always at work, night and day, and the air is so dry that I carry eggs from April to December without mold or "must" or shrinkage in candling. My capacity is 100,000 dozen in cases. I also carry grapes and other fruit successfully. The expense of carrying eggs by my system is less than one pound of ice per day to each case of eggs, to maintain a temperature of about 35 deg. above zero.

We usually put up ice here at a cost of eighty cents to $1 per ton in the ice house, packed.

There are no artificial ice plants here, though several breweries have plants for cooling their vaults artificially.

There is one large cold storage plant here besides mine, having "Wickes" system; two others on the "overhead" system; total storage capacity of the three houses, about seventy-five car loads of eggs.

The two cold storage houses which use the old style system of storing the ice in bulk on metal floor above the storage rooms, rely upon the cold air falling by gravitation and cooling the rooms below.

The "Wickes" plant, erected two years since, was filled full of eggs the first year, but most of the stock so carried, when taken out in the fall, were damp and "musty," entailing great loss on the owners, who brought suit for damages to the amount of about $9,000. These suits, not yet having reached for trial, no evidence has yet been produced to show whether this poor success was the fault of the system, or of those who operated it. In consequence, it stood nearly empty last year. This year, however, a shipper rented it, and has it about half full of eggs, "gambling" upon the outcome.

The pork packing houses at South Omaha have large cooling rooms for meats there and for sales rooms here, run by use of natural ice, of which they put up large quantities.

Natural ice is supplied by the local ice companies this year to large buyers, like the butcher trade, at $2.50 per ton, delivered to them at their places of business.

Omaha, Neb., June 11, 1891.

LATENT HEAT.

A writer on "Heat" in the *Tradesman* offers some interesting facts in condensed form, which will not be without interest to the readers of Ice and Refrigeration. He says:

Some will say, "How are we to tell what quantity of latent heat steam contains?" Just as we determine the amount of heat the pound of iron contained when it came from the furnace. Let 1,178 pounds of water be brought in contact with steam at 212 deg., until the water has received one pound, making 1,179 pounds. It will be seen by applying a thermometer, that this entire body of water has been raised one degree in temperature. So the pound of steam which it received, though showing but 212 deg., really contained 1,179 heat units. If but half the water had been used, it is obvious that two degrees would have been the resulting increase of temperature of the water. As is the case with liquids changing to gases, so metals and ice show no change in temperature while the process of melting goes on, and yet a large amount of latent heat is absorbed during the change. A very simple experiment illustrating this is given by Howell. If to a pound of newly fallen snow we add a pound of water at 170 deg., the snow will be melted, and the whole will show 32 deg., the temperature of the snow before melting. We see by this, 140 deg. have disappeared in the liquid and is termed the latent heat of ice, for it will be returned again when the water is frozen.

While all the inhabitants of cold climates may not have the above data, they well know that placing a tub of water near their vegetables will prevent freezing.

We also see in every-day life some practical demonstrations of the effect of evaporation and condensation, and the consequent absorption or diffusion of heat. The fevered brow of the invalid is rendered much cooler by the application of tepid than cold water. Simply because, with the first, a more sudden evaporation takes place, and the vapor sent off must have its 966 deg. of latent heat, and this is supplied from the sufferer and adjacent air. A volatile mixture is made, which, when poured on a red-hot plate of iron, will fall off in sheets of ice—a forcible illustration of the effects of sudden evaporation.

Again, when heat-laden vapor ascends to the clouds and falls in gentle rain, we see the hand of a munificent Providence in more ways than one, for were it not for the latent heat released in the upper air, we would have sheets and shafts of ice falling to the earth. Occasionally the violence of a storm wafts away the heat as fast as liberated, and we get the pelting hail.

A GREAT ICICLE.

At Sumas City, says the Seattle *Telegraph*, on Monday, April 27, last, a loud noise and slight shaking of the earth caused no little wonderment among residents near the hills. Investigation proved the cause to be an ice slide. A small and innocent spring issues from the side of one of the mountains, its waters spreading and flowing over a steep incline of rock. During the past winter months ice formed against this wall of stone, increasing in size until one vast icicle, fully twenty feet in thickness and 1,000 feet in length, projected into the valley below. From the warmth of the sun and its own weight it released its hold and thundered down the mountain side, carrying everything before it, even trees three feet in diameter. Those who have visited the place say that the foot of the cliff presents a mass of broken ice, trees, limbs and earth fifty feet in height. This is a repetition of occasional similar occurrences in previous years, but on a grander scale.

NOVEL ADVERTISING.

Henry Williams, a Pittsburgh theatrical manager, has originated a new means of advertising. He secured permission from the chief of police to deposit cakes of ice on the sidewalks for the occupants of the neighboring buildings to use if they chose. He then arranged with an ice manufacturing company to freeze lithographs of his coming attractions in big cakes of ice. The clearness of the ice gives the effect of the scenes being painted on its surface.

——J. E. Booge & Son, at Sioux City, erected large ice houses last winter for their ice supply.

COLD STORAGE ITEMS.

ALABAMA.

Russellville—The Russellville Ice Co. is erecting a cold storage warehouse in connection with the ice plant.

Selma—The Star Ice Co. is building a brick building for ice storage at Montgomery.

COLORADO.

Pueblo—The cold storage house of the Distilled-Water Ice & Cold Storage Co. has twenty-six cooling rooms, and has been very successful thus far.

GEORGIA.

Macon—The ice factory and cold storage house of the Planters' Oil & Ice Co. is completed and in operation, the De La Vergne machine being employed. The cold storage house has twelve compartments, some of which are used by the Armour Packing Co. for the storage of dressed beef.

Macon—The Macon Brewing Co. will, it is reported, increase the capacity of its cold storage plant.

FLORIDA.

Jacksonville—New machinery has been placed in the Jacksonville Refrigerator Ice Works.

IDAHO.

Ogden—Fred Kiesel, agent of a Milwaukee brewery, has built a beer storage house at Boise City, Idaho, using natural ice for refrigeration.

ILLINOIS.

Chicago—The Universal Refrigerating Co., of which Pension Commissioner Green B. Raum is a conspicuous member, has opened a cold storage house on West Jackson street.

Chicago—The Consumers' Pure Ice Co., of Chicago, are building an ice house; storage capacity, 2,000 tons.

Quincy—The ice making and cold storage plant of the Distin Produce Co., Quincy, Ill., on which work was begun May 10, has been completed, and is now in operation. The capacity is thirty tons of ice daily; refrigerating capacity, sixty tons. The cold storage house has 100,000 cubic feet of space, the machinery for which is independent of the ice plant.

INDIANA.

Kendallville—The McCray Cold Storage Co., of Kendallville, Ind., are looking for a site for a factory in the natural gas belt of Indiana. They manufacture refrigerators, cars, etc., and expect to work from seventy-five to 100 men. Anderson, Ind., is trying to locate the company there.

IOWA.

Des Moines—Mr. H. E. Teachout, of the Des Moines Ice Co., and others, are talking of putting up a cold storage warehouse, and want information as to systems, either for natural ice or artificial refrigeration.

MARYLAND.

Baltimore—Charles Markell, H. G. Vickery, E. L. Palmer and others have incorporated the Baltimore City Cold Storage & Warehouse Co., with a capital stock of $100,000.

MISSISSIPPI.

Winona—An ice factory is being erected by the Southern Ice & Cold Storage Co., of Chattanooga, Tenn.

NORTH DAKOTA.

Grand Forks—The Nash Bros. will erect a cold storage house along the Northern Pacific tracks at this place. They are engaged in the wholesale fruit and produce business.

VIRGINIA.

Suffolk—Mr. M. F. Lloyd is building a beer bottling refrigerating house near the ice factory.

TRADE CORRESPONDENCE.

[The publishers do not hold themselves responsible for the utterances of correspondents on any subject. No anonymous communications will receive attention.—ED.]

NEW YORK, July 21, 1891.

To the Editor of ICE AND REFRIGERATION:

GENTLEMEN.—In answer to your correspondent inquiring about the "Liquid Pictet," I beg to state that this same liquid was prepared *by me for the first time, and used in an ice machine as early as September, 1883*, long before Mr. Pictet had made what I believe to be independent researches on the same subject; his French patent, the first secured, bears date December, 1884. As no patent had been secured by me for this liquid at the time the experiments were made, and none were solicited before the spring of 1885, I found myself in interference with Mr. Pictet's patent, when the American Pictet Artificial Ice Co., of New York, applied for one in this country for the same liquid. Having proved priority after a protracted examination made to the satisfaction of the patent office, the United States patent office decided the case in my favor, and the *American patent* for what you call the "Liquid Pictet" has been granted and issued to me; it bears date November 30, 1886. No. 353,378.

AUGUSTE J. ROSSI, C. E.



NATURAL ICE NEWS.

July trade has been anything but satisfactory, the weather having been remarkably cool, reducing the consumption of ice to below the average for this month in the west. Stocks in store have, however, begun to grow lighter in the Atlantic cities, and the trade on the Kennebec, the main source of supplies, which was very dull during June, has taken on new life during the past two to three weeks. On the 17th ult., thirty-seven vessels from Smithtown to Iceboro were waiting to load. Shipments were somewhat delayed, until after the 20th, by scarcity of help, the usual supply of hands being at work in the hay fields; and all along the river the trade feels in better humor, and hopes for a hot August to give it the real stimulus it needs after so mild a June and July.

A late report says that ice shipments from the Kennebec are lighter toward the close of July, owing to continued mild weather. Clark & Chapin, at Gardiner, loaded 1,000 tons after the 27th, and then stopped indefinitely. The Great Falls Co. sent out one ship load on the 23d, but no more vessels were in sight that week; and Mr. Haley continues periodical shipments from his houses at Trott's Point. The houses of F. W. Ayer & Co., however, continue shipments, and by fall they expect to have their houses empty. A large share of their ice goes by schooner to Baltimore.

——Extra ice trains were run during July from Milton, N.H., to Boston.

——The Waukesha Ice Co. are shipping by rail from three to eight cars daily.

——Considerable ice has been shipped to St. Louis from Stillwater, Minn., during the past month.

——Thomas Bros., of Omaha, Neb., are shipping ice to Lawrence, where the crop was a failure last season.

——The lake schooner J. E. Gilmore recently loaded ice at Sturgeon Bay, Wis., for Buffalo. This is a remarkably long haul for ice.

——The Standard Ice Co., of New York city, has purchased river front property at Malden, N.Y., on which a large ice storage house will be erected.

——S. P. Udell and Arthur Ainsworth have purchased the S. P. Bennett Fuel & Ice Co.'s business at Grand Rapids, Mich., which they will continue under the old firm title.

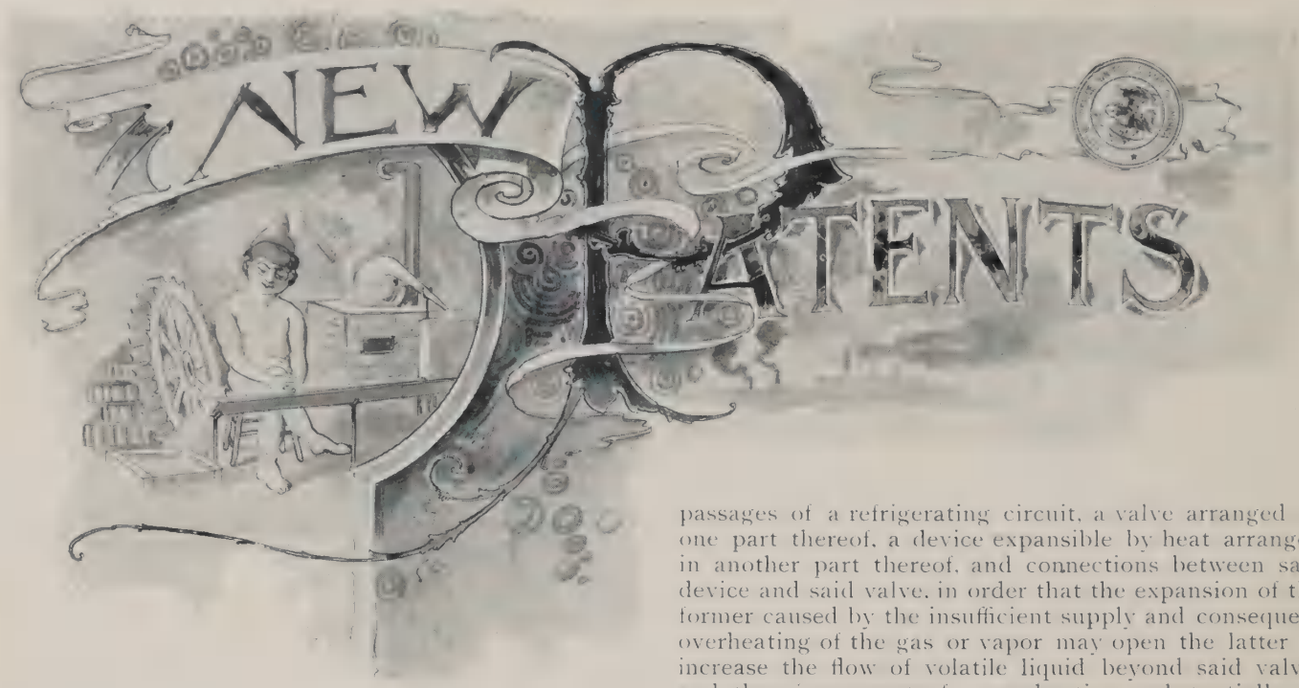
——The Northern Lake Ice Co., a well known Louisville and Indiana ice company, has renewed for ten years the ice cutting privilege of the "wide water," at Lafayette, Ind., at a rental of $2,500 per annum.

——The Leadville & Evergreen Lakes Ice Co. have offered to sell ice at $3.50 per ton F. O. B. to Denver parties, who have declared war on the Colorado Ice & Cold Storage Co., which controls the ice trade of Denver.

——The employes of the Ridgewood Co., of Greenbush, Pa., shippers of ice from Clark & Lawrence's house on Green island, on the Hudson, between Castleton and Albany, struck recently for an increase of pay from $1.50 to $1.75 per day. New hands were employed by the company.

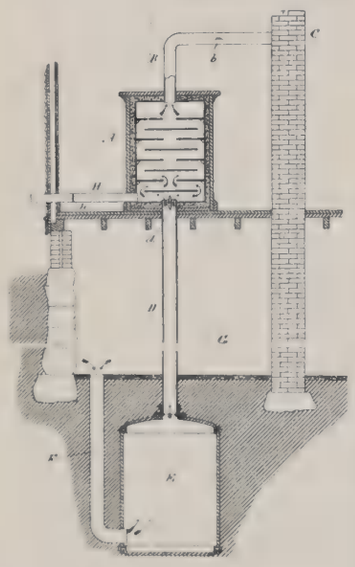
——The Gloninger's Springs Ice Co. has been organized at Lebanon, Pa., with Dr. A. B. Gloninger as president; Geo. B. Schock, secretary; E. M. Woomer, treasurer. The company propose to utilize Gloninger's spring for making an ice cutting field, a dam to be erected to give a water surface of ten acres.

——Weeks & Nickerson, ice shippers for F. W. Ayer & Co., Bangor, Me., will handle about 25,000 tons, all sold on contracts to Baltimore, Philadelphia and Richmond. The ice is called for quite slowly, owing to light consumption at points of delivery, and Ayer & Co. would seem to be the only firm doing any considerable wholesaling in Bangor. A schooner, June 25, took out 900 tons for Baltimore.



We append below the most important new patents, relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

REFRIGERATING DEVICE.

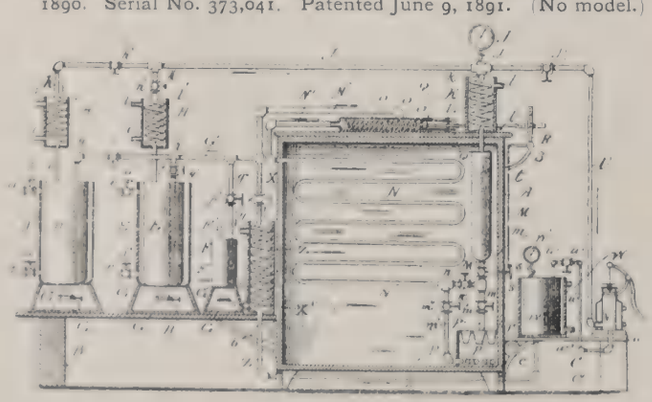


No. 455,522. Henry C. Weeden, Quincy, Mass. Filed October 21, 1890. Serial No. 368,830. Patented July 7, 1891. (No model.)

Claim.—In combination, the elevated food preserving chamber *A*, provided with an exhaust pipe *B*, a subterranean air tank or storage chamber, air pipes connecting the said subterranean chamber with the food preserving chamber and outer air, respectively, and means, substantially as described, for producing a draft or exhaust of air from the food chamber, as set forth.

REFRIGERATOR.

No. 453,651. Charles F. Miller and Alexander W. Carlile, Lancaster, Pa.; said Carlile assignor to said Miller. Filed Nov. 29, 1890. Serial No. 373,041. Patented June 9, 1891. (No model.)

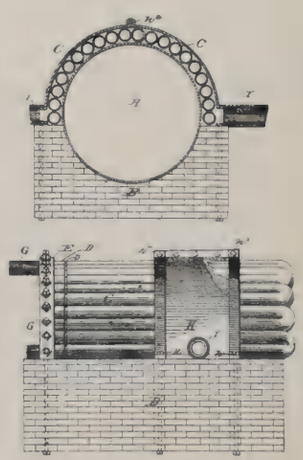


Claim.—1. In combination with the pipes and other passages of a refrigerating circuit, a valve arranged in one part thereof, a device expansible by heat arranged in another part thereof, and connections between said device and said valve, in order that the expansion of the former caused by the insufficient supply and consequent overheating of the gas or vapor may open the latter to increase the flow of volatile liquid beyond said valve, and thus compensate for overheating, substantially as set forth.

REFRIGERATING ATTACHMENT.

No. 455,456. Arthur B. Wood, Troup, N. Y. Filed March 26, 1891. Serial No. 386,507. Patented July 7, 1891. (No model.)

Claim.—1. In a device of the kind described, the combination, with a water main, of a divided casing above the same, a heading surrounding the upper portion of the main, a series of longitudinally disposed cooling coils on the main below the casing, a series of three-way valves for the respective branches of the coils, and a supply and discharge pipe for the coils, substantially as described.

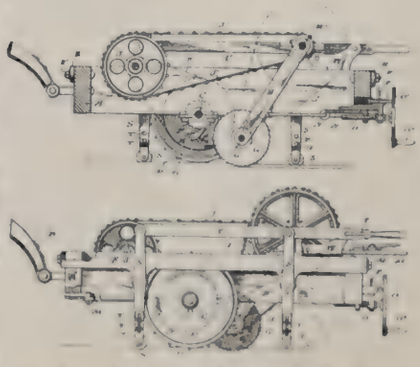


2. In an apparatus of the kind described, the combination, with a water main, of a series of longitudinally disposed pipes on the top of the main connected in pairs, a heading for the pipes, valves in the heading, a casing above the pipes, an inlet and outlet pipe for the casing, and a supply and a discharge pipe for the longitudinal pipes, substantially as described.

ICE CUTTING MACHINE.

No. 455,323. Frank J. Gutmann and Gustav Johnson, Milwaukee, Wis., and Charles P. Johnson, St. Charles, Ill. Filed August 11, 1890. Serial No. 361,654. Patented July 7, 1891. (No model.)

Claim.—1. The combination, in an ice cutting machine, with a swinging arm and the circular saw supported thereon and connected mechanically to the driving mechanism, of a block *N*, movable in ways in the frame, and connected by a rod to the swinging saw-carrying arm, screw-threaded rod *O*, arranged to adjust the block *N*, hand wheel *O'*, fixed on

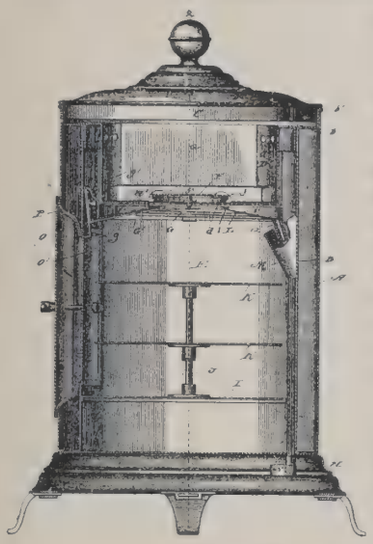


the rod *O*, and locking bolt *P*, adapted to lock the hand wheel in position, substantially as described.

REFRIGERATOR.

No. 447,467. Oswald Kutsche, Chicago, Ill. Filed January 14, 1890. Serial No. 336,858. Patented March 3, 1891. (No model.)

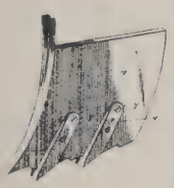
Claim.—1. A refrigerator having the usual ice chest and refrigerating chamber, said ice chest having perforations in its bottom for the passage of the cold air, a flange rising from the bottom wall of said chamber exterior to said perforations and having apertures therein, and a valve normally suspended above said flange, and a pivoted arm, upon the inner end of which said valve is seated, and its outer end projected to engage the door of the refrigerator when closed and adapted to be lowered by the opening of the door, whereby to seal said passage, substantially as described.



CUTTER FOR ICE PLOWS.

No. 449,517. Henry Bodenstein, Staatsburg, N. Y. Filed June 26, 1890. Serial No. 356,852. Patented March 31, 1891. (No model.)

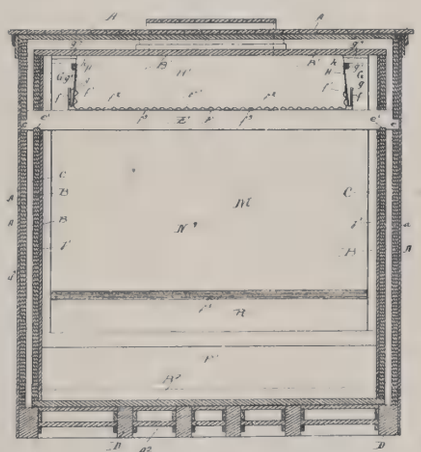
Claim.—1. A cutter or blade for ice plows, having a series of oblong throats having their side walls beveled the full length thereof, teeth fitting in said throats and having their upper ends split, forming lips, and screws passing through said lips for securing the teeth in the throats, said teeth being thicker than the blade and having their lower ends inclined to provide the front sharp cutting edge, as shown.



REFRIGERATOR CAR.

No. 454,869. Eugene R. Hutchins, Chicago, Ill., assignor to the Hutchins Refrigerator Car Co., same place. Filed June 19, 1890. Serial No. 356,000. Patented June 30, 1891. (No model.)

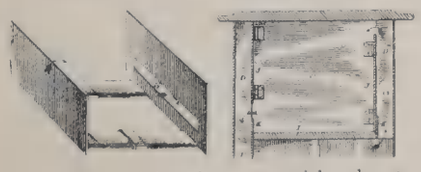
Claim.—1. The combination in a refrigerator car, of a cooling chamber, a metal pan or trough immovably secured over that chamber, another metallic pan or trough having a corrugated bottom resting on the bottom of the first mentioned trough, and means for securing it removably therein, both pans or troughs being water tight over the cooling chamber, as and for the purpose set forth.



REFRIGERATOR.

No. 455,556. John J. Wright, Burlington, Vt. Filed October 25, 1890. Serial No. 369,329. Patented July 7, 1891. (No model.)

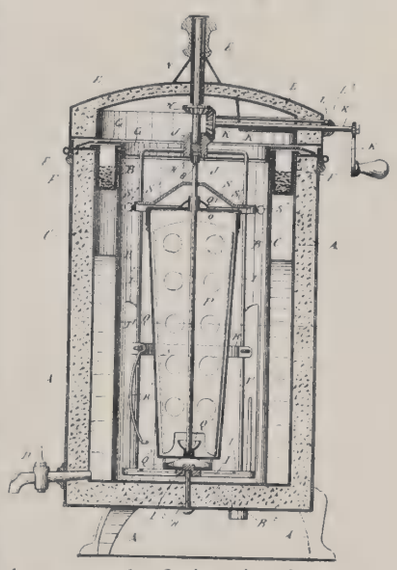
Claim.—1. In a refrigerator, the combination, with a casing, of a removable ice box placed in its upper end, which is shorter than the width of the casing to form a flue at each end thereof, and having one side shorter than the other, the longer side having an opening near its bottom, and a vertical wall secured to the box at its longer side and extending to near the bottom of the said casing, the box being shorter than the width of the casing to form a flue at each end thereof, substantially as described.



COOLER AND FREEZER.

No. 455,663. Paul L. Dermigny, New York, N. Y. Filed December 31, 1890. Serial No. 876,321. Patented July 7, 1891. (No model.)

Claim.—1. A cooler and freezer, consisting of an outer and inner receptacle having a chamber between them, said chamber being provided with a faucet, a ring-shaped receptacle fitting in the upper end of the chamber and having a perforated bottom, and two sets of beaters or stirrers in the inner receptacle and revolving in opposite directions, substantially as described.

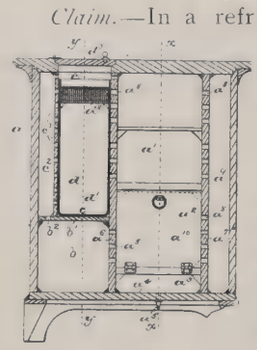


2. A cooler and freezer consisting of two concentric vessels having a chamber between them, said chamber having a faucet, a ring-shaped receptacle fitting in the upper part of the chamber, a set of beaters or stirrers in the inner receptacle, a third vessel within the beaters or stirrers, and a second set of beaters or stirrers in the third vessel and rotating in an opposite direction to the first-named beaters or stirrers, substantially as described.

REFRIGERATOR.

No. 455,891. John Stanard, Newark, N. J. Filed September 23, 1890. Serial No. 365,895. Patented July 14, 1891. (No model.)

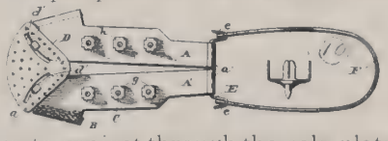
Claim.—In a refrigerator, the combination, with the ice chamber a^2, provided with an ice grate made up of bars c, as set forth, and a door for said chamber, pivoted at the bottom, of a chamber b, separated from the ice chamber by a partition a^6, having perforations a^8, a chamber c, directly above said chamber b and separated therefrom by a partition b', and a water cooler d in said chamber c, provided with a faucet d', as and for the purposes set forth.



ICE CREEPER.

No. 456,060. Michael R. Reilly, Montesano, Wash. Filed February 26, 1891. Serial No. 382,899. Patented July 14, 1891. (No model.)

Claim.—1. An ice creeper provided with a sole plate and a calk secured thereto by means of a fastening plate apertured to receive the shank of the calk and having prongs to project through the sole plate and be clinched thereon, substantially as described.



ICE CREEPER.

No. 456,515. Lewis Ramborn, Philadelphia, assignor of one-half to Nelson H. Strong and Wilmer W. Lamborn, both of Media, Pa. Filed January 17, 1891. Serial No. 378,152. Patented July 21, 1891.

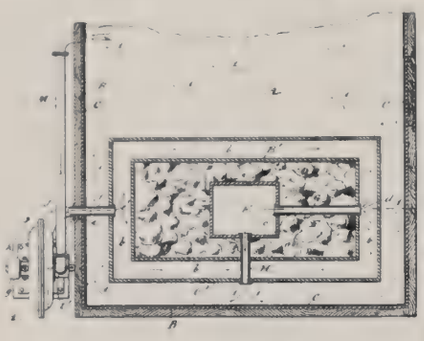
Claim.—An ice creeper consisting of a spring wire a, having a series of bends formed thereon, and its ends turned up and pointed to constitute hooks a', with spurs b secured within the bends of the wire, substantially as described.



AIR COOLING APPARATUS.

No. 456,444. George W. Smith, Mount Vernon, assignor of one-half to John M. Shinn, Velhorm Manor, N. Y. Filed November 24, 1890. Serial No. 372,435. Patented July 21, 1891. (No model.)

Claim 1.—A refrigerating apparatus consisting in the storage chamber, an ice box therein provided with a central chamber *E* and an outer surrounding wall *C*, spaced to form the passage *b*, a pipe or passage *G*, connecting the chamber *E* and space *b*, a pipe or passage *H*, connecting the chamber *E* with the interior of the storage chamber, and a blower for exhausting air from the storage chamber and returning it to the space *b*, substantially as set forth.



COLD FUN.

A SEASONABLE VERSION.

It was a proofreader who had served an apprenticeship in a drug store that let Heber's famous old hymn get into print in this form:

From Greenland's icy mountains,
From India's chloral strand,
Where Afric's soda fountains
Roll down their golden sand.

***

REFRIGERATION.

In a box at the opera they sullenly sat,
And the veriest tyro could see
That they were enjoying a terrible spat,
And were miserable as they could be.

At length he forgot, as he looked at the stage,
And exclaimed in a tone of delight;
"The villain is foiled, and fruitless his rage,
But I don't understand the girl's fright."

In a tone that was chill as a December blast,
The maiden made haste to reply:
"She has just seen your face"—then the box was so cold
That the frost cracked the glass in his eye.

—*Texas Siftings.*

WANTED AND FOR SALE ADVERTISEMENTS.

[The charge for advertisements in this column is $3 each insertion for seventy words or less, and twenty-five cents for each additional fourteen words. No advertisements will be inserted unless accompanied by the necessary cash. Parties answering these advertisements must write to the addresses given, as the Publishers decline to furnish any information concerning them.]

Salesman Wanted.

An experienced ice machine salesman having good references, can obtain a good position by addressing "C. M. A.," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Foreman Wanted.

A first-class foreman with $10,000 to invest in a good paying ice factory in Kentucky. Address with references, "Ice Factory," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Second Hand Ice Machine Wanted.

Wanted, a 20 to 25-ton ice machine, second-hand. Parties offering will please state name of maker, condition of machine and lowest price. Address "Norman," care of ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Situation Wanted.

An experienced engineer wishes to secure a situation in a northern state to run an ice or refrigerating machine. Understands the business thoroughly. Address "James W. M.," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Engineer and Manager for Ice Factory Wanted

A head engineer and manager for an ice factory of 10 tons capacity, of latest patent. The party wanted must have thorough knowledge of the compression system, must be energetic and able to run the works in the most economical way. A party with some money has a chance to get an interest in the concern, if he is the proper man for the place. This factory has been in operation for many years, and has paid good dividends. Best references are required. Address "Engineer," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

MINERAL WOOL

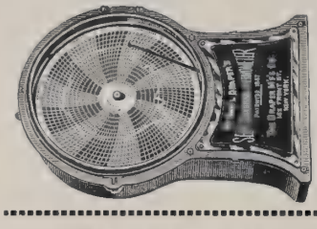
.....BEST INSULATOR FOR.....

Ice Houses, - - -
Cold Storage Rooms,
Etc. - - - - - - -

REFERENCES ON APPLICATION.
SAMPLES FREE. . . . . .

U. S. MINERAL WOOL CO. 2 CORTLANDT ST. N. Y. CITY.

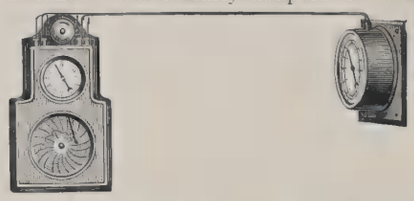
DRAPER'S SELF-RECORDING THERMOMETER



This instrument is especially adapted for use in cold storage warehouses and freezing rooms, for keeping a correct and continuous record, in ink, of the temperature, affording absolute proof of the temperature maintained.
Size 14x20 in. Price, $30.
Size 9x14 in. Price, $15.
Write for particulars.
THE DRAPER MFG. CO.
152 Front St., NEW YORK.

Telemeter Instruments.

For recording and indicating temperature and pressure at a distance. Particularly adapted to Cold Storage, to indicate in the office or engine room the temperature in any or all the refrigerating rooms.



FOR DESCRIPTION AND PRICES SEND TO

STANDARD THERMOMETER CO.
PEABODY, MASS.
New York Office, 18 Courtlandt St. Boston Office, 70 Pearl St.

HILPERT & CHANDLER
ENGRAVERS
BY ALL PROCESSES.
REFER TO CUTS IN THIS PAPER FOR SPECIMENS OF WORK
167 DEARBORN ST. CHICAGO.



A. WEISKOPF
111 Fifth Ave., CHICAGO,
.....MANUFACTURER AND IMPORTER OF.....
THERMOMETERS
AND HYDROMETERS.
Ice Machine Thermometers and
Ammonia Hydrometers . . . .
CELLAR AND . . . . . .
CHILL ROOM THERMOMETERS.
Thermometers in angle shape made to order from sketch or specification.
ESTIMATES FURNISHED ON APPLICATION.



THIS ENGRAVING REPRESENTS THE WORKS OF THE

Blymyer Ice Machine Co., Cincinnati, Ohio.

Manufacturers of Ice and Refrigerating Machines, exclusively. The Absorption Machine, made by the Blymyer Ice Machine Co., is superior to any Compression Machine, either as a Refrigerating or Ice-Making Machine. It requires no steam engine or complex moving machinery. It saves 25 to 40 per cent of the fuel, and saves ammonia and labor. The cost of repairs is small, and the machine will outlast Compression Machines several times over. It is not necessary to buy these machines in pairs, as there is no danger of serious stoppage. These machines are ***RADICALLY DIFFERENT*** from all other Absorption Machines, and are in every way superior to them.



BELOW will be found a list of Ice-Making and Refrigerating Machines made by us. Every one of these machines has been in continuous use since erected, and is in use now. None have failed to fill their guarantees satisfactorily; none have been superseded by other machines. The entire capacity of our works having, up to the present time, been taken up with the manufacture of Ice-Making Machines, no agents have solicited orders for Refrigerators. Such orders as have been taken have been merely incidental. Having easily taken the lead in the Ice-Making Machine field, the manufacturers, with their enlarged capacity, will now enter the Refrigerator field (which is much the easier of the two in which to make a good record) in earnest, and respectfully solicit correspondence. Send for our catalogue.

ICE-MAKING MACHINES.

No.	Size.	NAME.	ADDRESS.
1	8 Ton.	Meridian Ice Mfg. Co	Meridian, Miss.
1	10 "	Baton Rouge Ice Mfg. Co	Baton Rouge, La.
1	15 "	Evansville Ice and Cold Storage Co	Evansville, Ind.
1	5 "	A. Moresi	Jeanerette, La.
1	15 "	Lookout Ice and Cold Storage Co	Chattanooga, Tenn.
1	10 "	Morris Ice Co	Jackson, Miss.
1	15 "	Texarkana Ice Co	Texarkana, Tex.
1	30 "	Lookout Ice & Cld. Stor. Co. (2d Order)	Chattanooga, Tenn.
1	5 "	Gadsden Ice Co	Gadsden, Ala.
1	6 "	Sheffield Ice Co	Sheffield, Ala.
1	5 "	Decatur Ice Co	Decatur, Ala.
1	30 "	Crystal Ice Co	Wichita, Kan.
1	3 "	Denton Ice Co	Denton, Tex.
1	5 "	Van Buren Ice and Coal Co	Van Buren, Ark.
1	5 "	Biloxi Artesian Ice Mfg. Co	Biloxi, Miss.
1	25 "	Hutchinson Ice Mfg. Co	Hutchinson, Kan.
1	12 "	Parkersburg Ice Co	Parkersburg, W.Va.
1	30 "	Union Ice Co	Denver, Col.
1	3 "	Dominick & Karston	West Point, Miss.
1	3 "	DeCoppet Ice Co	Somerset, Ky.
1	35 "	Evansv'le Ice & Cld.Stor.Co.(2d Order)	Evansville, Ind.
1	2 "	Van Horn & Chambers	Lebanon, Ohio.
1	4 "	John C. Webb	Demopolis, Ala.
1	12 "	Huntington Ice and Storage Co	Huntington, W.Va.
1	15 "	Corryville Artificial Ice Co	Cincinnati, Ohio.
1	3 "	Tupelo Ice Co	Tupelo, Miss.
1	30 "	Wheeling Ice and Storage Co	Wheeling, W.Va.
*1	10 "	Ft. Payne Ice and Cold Storage Co.	Ft. Payne, Ala.
*1	10 "	Coronado Beach Co. (Hotel del Coronado)	San Diego, Cal.
*1	1 "	Walter Aiken (Hamilton Hotel)	Hamilton, Bermuda
*1	20 "	Decatur Cold Storage and Ice Co	Decatur, Ill.
*1	12 "	Marietta Ice Co	Marietta, O.
*1	35 "	Dayton Ice Mfg. & Cold Storage Co	Dayton, O.
*1	30 "	Zanesville Artificial Ice Co	Zanesville, O.
*1	35 "	Evansv'le Ice & Cld.Stor.Co.(3d Order)	Evansville, Ind.
*1	3 "	Connolly & Curtis	Columbus, Miss.
*1	5 "	Lebanon Artificial Ice Co	Lebanon, Ky.
*1	5 "	Cynthiana Elec. Light & Power Co	Cynthiana, Ky.
*1	5 "	Grenada Cream'y, Cld.Stor. & Ice. Co	Grenada, Miss.
*1	15 "	Washington Ice Co	Washington, Ind.
*1	30 "	Wheeling Ice & Storage Co. (2d Order)	Wheeling, W.Va.
*1	32 "	Consumers Ice Co	San Francisco, Cal.
*1	15 "	Shelbyville Artificial Ice Co	Shelbyville, Ind.
*1	30 "	Pueblo Distilled Water Ice and Cold Storage Co	Pueblo, Col.
*1	15 "	Skinner & Olson	Topeka, Kan.
*1	35 "	Fort Wayne Artificial Ice Co	Fort Wayne, Ind.
*1	35 "	Evansv'le Ice & Cd.Stor.Co. (4th Order)	Evansville, Ind.
*1	55 "	Dayton Ice Mfg. & Cd. Sto. Co. (2d Order)	Dayton, O.
*1	15 "	Ashland Artificial Ice Co	Ashland, Ky.
*1	50 "	Corryville Artificial Ice Co. (2d Order)	Cincinnati, O.

* These machines were erected in 1890.

ICE-MAKING MACHINES.

No.	Size.	NAME.	ADDRESS.
**1	8 Ton.	Gibson House	Cincinnati, O.
**1	10 "	Palace Hotel	San Francisco, Cal.
**1	30 "	The People's Ice Co	Birmingham, Ala.
**1	35 "	Citizens Ice Co	Los Angeles, Cal.
**1	20 "	Civill & White	Colorado Spr'gs, Col.
**1	30 "	Pueblo D.W. Ice & Cd.S.Co. (2d Order)	Pueblo, Col.
**1	60 "	Colorado Ice and Storage Co	Denver, Col.
**1	25 "	E. B. Cornell	Tampa, Fla.
**1	5 "	Mr. H. G. Meumann	Bessemer, Ala.
**1	20 "	Consumers Ice Co	Vicksburg, Miss.
**1	35 "	Artificial Ice and Storage Co	Canton, O.
**1	12½ "	Frigid Ice Mfg. Co	Joplin, Mo.
**1	30 "	Crystal Ice Co	Albuquerque, N. M.
**1	15 "	Meridian Ice Co. (2d Order)	Meridian, Miss.
**1	5 "	Dayton Ice Co	Dayton, Tenn.
**1	15 "	Decatur Ice Co. (2d Order)	Decatur, Ala.
**1	12½ "	The Ruddick Artificial Ice Co	Columbus, Ind.
**1	10 "	Mr. August Erath	New Iberia, La.
**1	55 "	The Crystal Ice Mfg. & Cd. Sto. Co.	Columbus, O.
**1	32 "	Consumers Ice Co. (2d Order)	San Francisco, Cal.
**1	15 "	Peru Ice and Cold Storage Co	Peru, Ind.
**1	55 "	The Crystal Ice Mfg. and Cd. Stor. Co. (2d Order)	Columbus, O.
**1	32 "	Lafayette Artificial Ice Co	Lafayette, Ind.
**1	50 "	R. T. McDonald & Judah Hart	New Orleans, La
**1	12 "	John Hoey (Hollywood Hotel)	Long Branch, N. J.
**1	15 "	Bridgeport Electric and Ice Co	Bridgeport, Ala.
**1	5 "	Fleischman & Co	Cincinnati, O.

** These machines were erected in season 1891.

REFRIGERATING MACHINES.

2	50 Ton.	Louisiana Brewing Co	New Orleans, La.
1	40 "	Toledo Brewing and Malting Co	Toledo, O.
1	40 "	Hudepohl & Kotte (Brewery	Cincinnati, O.
1	50 "	Savannah Brewing Co	Savannah, Ga.
1	25 "	Schantz & Schwind (Brewery)	Dayton, O.
1	15 "	John Smith's Sons (Brewery)	Youngstown, O.
1	12 "	Christ Diehl (Brewery)	Defiance, O.
1	12 "	Genessee Oil Works	Buffalo, N. Y.
1	12 "	S. Davis, Jr., & Co. (Packers)	Cincinnati, O.
1	50 "	Occidental Packing & Provision Co	Lincoln, Neb.
1	15 "	Thos. McFadden, Jr. (Cold Storage	Pittsburgh, Pa.
1	15 "	Grocers' Supply Co. (Cold Storage)	Pittsburgh, Pa.
*1	40 "	Adolph Coors (Golden Brewery)	Golden, Col.
*1	20 "	F. Conrad (Brewery)	Anaheim, Cal.
*1	25 "	The Sachs-Prudeus Ale Co	Dayton, O.

* These machines were erected in 1890.

DIRECTORY OF

Ice Factories, Ice Dealers and Cold Storage Houses.

THE PICTET ICE WORKS,
Manufacturers of Artificial Ice from Filtered and Double Distilled Lake Erie Water.
Capacity, 30 tons per day.
20, 22 & 24 Center St., Cleveland, O.

THE WASHINGTON MARKET CO.
Central, accessible and close to business, with over 300,000 feet cold storage space.
Center Market: 7th and Pa. Ave., N. W.,
Washington, D. C.

CENTRAL ICE CO.
REPRESENTING Lookout Ice & Cold Storage Co.
Chattanooga Ice & Bottling Co.
Ice Capacity, 125 Tons daily. Big Spring Ice Co.
Chattanooga, Tenn.

NORTHWEST COLD STORAGE & ICE CO.
WM. MCGUIRE, Sec'y and Treas.
C. H. PRESCOTT, Pres. J. C. LEWIS, Vice-Pres.
WM. MCGUIRE, Mgr. Portland, Ore.

STANDARD ICE CO.
Daily capacity, 135 tons.
Office: Wall Street.
Factories: Atlanta, Iceville and West End.
MORRIS BENJAMIN, Mgr. Atlanta, Ga.

J. WALTON CURTIS,
ICE BROKER,
Ice bought and sold on commission.
P. O. Box 1264. Boston, Mass.

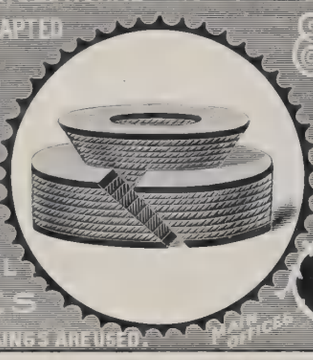
EXCELSIOR ICE & COLD STORAGE CO.
Ice capacity, 80 tons daily.
W. H. HOWE, Prop. Nashville, Tenn.

GEORGIA ICE CO.---N. O. ICE MFG. CO.
Capac'y, 40 tons daily. Capac'y, 80 tons daily.
J. M. BEATH, Gen. Mgr. H. H. BLANK, Supt. N. O.
Atlanta, Ga. New Orleans, La.

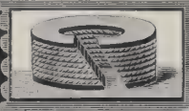
JAMES McCARTHY & SON,
Wholesale and Retail dealers in Ice,
Winter and Summer Shipments,
Lake Bras D'Or, Nova Scotia.

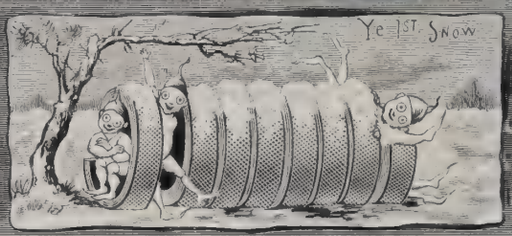
THE GARLOCK PACKING CO.

ELASTIC RING, SECTIONAL AND SPIRAL PACKINGS
ESPECIALLY ADAPTED FOR STEAM, WATER, AMMONIA AND ALL PLACES WHERE PACKINGS ARE USED.



EQUALED BY NONE







PALMYRA, N.Y. ROME, GA. OMAHA, NEB. | PITTSBURGH 54, 5th AVE | NEW YORK 194 WATER ST. | CHICAGO 94 FRANKLIN ST. | PHILADELPHIA 22 & 24 N. 4th ST. | PORTLAND, ORE.

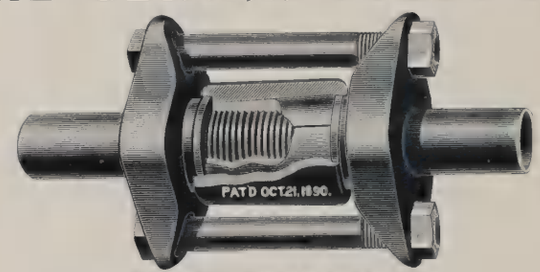
TANKS AND SHEET IRON WORK

OF EVERY DESCRIPTION.



CONTRACT FOR THE COMPLETE EQUIPMENT OF
ICE MAKING AND COLD STORAGE PLANTS.

THE CLIMAX COUPLING



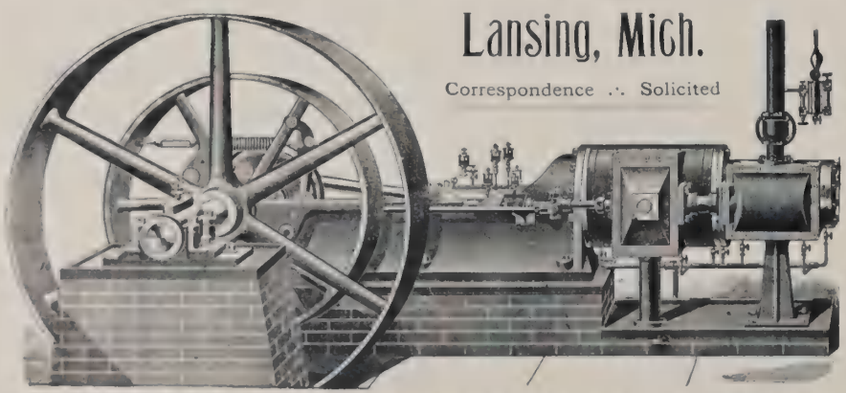
A NEW AND ORIGINAL INVENTION.
Unsurpassed for Efficiency, Strength, Durability and Economy.
Investigation will establish its superiority over every other known pipe-joint, particularly for Ice and Refrigerating Plants using ammonia.
For further information, testimonials, prices, etc., address

ENOCH LAWSON,
229 FULTON STREET,
SAN FRANCISCO, CAL.

LANSING IRON AND ENGINE WORKS

Lansing, Mich.

Correspondence .·. Solicited



[BACK VIEW TANDEM COMPOUND ENGINE, MADE BY THE LANSING IRON AND ENGINE WORKS.]

MANUFACTURERS OF

COMPOUND
CONDENSING
AUTOMATIC

ENGINES

Boiler, Sheet Iron and Tank Work for Ice Factories and Cold Storage Plants a Specialty . . . . . .



NEW FEED-WATER PURIFIER AND HEATER

USES LIVE STEAM

This cut shows our Feed Water Heater and Filter combined. Perfectly purifies the feed-water and delivers it to the boiler freed from scale producing elements and sediment. FULLY GUARANTEED.

STILWELL'S PATENT IMPROVED

Lime Extracting Heater. Uses Exhaust Steam. Separates the oil from the Steam and Water. It Regulates the Feed. The Pipes Never Pound. Prevents Scale in Steam Boilers, removing all Impurities from the water before it enters the Boiler.

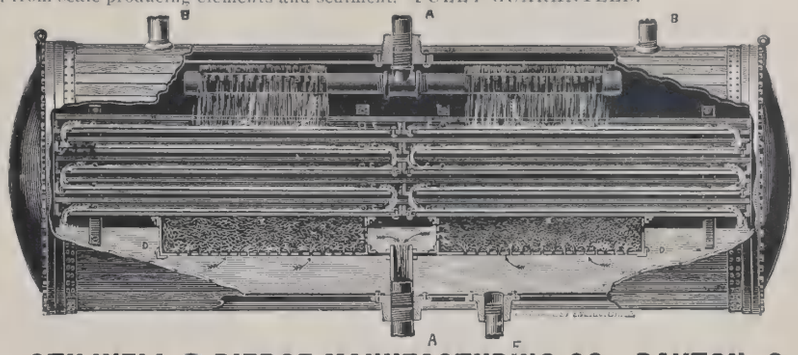
THOROUGHLY TESTED.

Over 4,500 of them in daily use.

This upright view is a fac-simile of the appearance of the shelves of a No. 5 Heater at work on ordinary Lime Water, when the door was removed after the Heater had been running two weeks.

ILLUSTRATED CATALOGUE FREE.

ESTABLISHED IN 1866.....



STILWELL & BIERCE MANUFACTURING CO., DAYTON, O.

THE P. FLEMING COMPANY

A. TSCHOPIK & SON, Proprietors.

IRON PIPE, FITTINGS AND BRASS GOODS .

SEND FOR PRICE LIST AND DISCOUNTS.

A full line of Asbestos Rubber and other Packing suitable for Ice Machines.

CHATTANOOGA, TENN.

A. W. SWANITZ, CONSULTING ENGINEER,

AND EXPERT IN

Ice AND Refrigerating Machinery

CORRESPONDENCE SOLICITED . . .

701 STOCK EXCHANGE BUILDING,

CHICAGO.



AUG. OHLSEN. JOS. MECKLER.

QUEEN CITY Omnibus and Wagon MFG. CO.

Builders of all Kinds of Vehicles.

Cor. Charles and Plum Sts.,

CINCINNATI, O.

SELDEN'S PATENT PACKINGS

FOR STUFFING BOXES



The BEST Packing for Ammonia, Air, Steam or Water. Used in Ice and Refrigerating Plants in this and other countries. Give it a trial. If your supply store does not keep it in stock, ask him to get it from the manufacturer.

RANDOLPH BRANDT,
38 Cortlandt St.,
New York, U. S. A.

THE WESTERN ICE MACHINE CO.

OTTO HOFFMANN, PROPRIETOR.

Ice AND Refrigerating Machinery

FOR BREWERIES, PACKING HOUSES, ICE FACTORIES, COLD STORAGE PLANTS, MARKETS, CONFECTIONERS, ETC.

Every Part Accessible While in Motion. . . . . .

The Most Cooling with the Least Expense. . . . .

THIS machine is the simplest, cheapest in first cost and after expense, is more easly handled than any other, and takes less room. Absolutely no possibility of leaking Ammonia. Machines of any capacity from smallest to the largest. We would be pleased to make Estimates, and believe we can show you a saving in cooling your cellars. . . . . .

WESTERN ICE MACHINE CO.

Office, Room 605 Northern Office Building, Cor. La Salle and Lake Sts.,

CHICAGO, ILL.

See this space next issue for Illustration of Machine.

IMPORTANT TO ICE MAKERS.

TRI-SODIUM PHOSPHATE CHEMICAL WATER PURIFIER.

PATENTED

A staple salt for the purification of water, ***HOT*** or ***COLD***, free from injurious action to ice, water or metals.
It prevents incrustations in boilers, and yields an absolutely pure steam for condensing and freezing.
It will prevent incrustations or corrosion to cooling coils, when applied to water passing over them.

By its use the impurities are rapidly eliminated from hot or cold water, by precipitation in tanks, producing a clear, soft, wholesome water for freezing or other purposes.

Send for our book "Worth Knowing," containing valuable information on ***Water Treatment.***

KEYSTONE CHEMICAL COMPANY, Patentees and Manufacturers,

3 South Front Street, PHILADELPHIA. — 65 South Canal Street, CHICAGO.

STRONG TESTIMONY

CHAMPION ICE MANUFACTURING AND COLD STORAGE CO.
COVINGTON, KY., June 27, 1891.

KEYSTONE CHEMICAL CO.

Gentlemen: In answer to your inquiry as to how we like your Tri-Sodium Phosphate, will say that we have been using it for two years with the best of results, both here and at our plant in Ironton, O. We find that it keeps our boilers clean, and the condensed steam from them is absolutely pure, and therefore does not affect the ice manufactured from it in the least. Condensed steam from boilers usually carries an insipid, smoky or bitter flavor with it into ice, but this is entirely overcome. We have the reputation of having the best artificially manufactured ice in this country; it is clear, odorless and tasteless, in fact absolutely pure, and we "bank" our last dollar on your Tri-Sodium Phosphate.

Yours truly,
CHAMPION ICE MFG. & COLD STORAGE CO.
(COPY) R. W. DUGAN, Sup't and Treas.

CAPACITY 300 PER DAY.



WRITE FOR PRICES



WASHINGTON, D. C., November 29, 1890.

It gives us great pleasure to recommend your Ice Moulds to any one requiring a first-class Ice Can. Out of ***over two thousand*** cans in daily use for over six months we have not had a ***single leaky*** one yet. The ice blocks, 300 pounds in weight are discharged from them with great ease within a few minutes time, and the loss of shrinkage hardly perceptible.

J. Harrison Johnson, Pres't. THE HYGIENIC ICE CO.

MEMPHIS, TENN., November 24, 1890.

We write to ask the price of Ice Cans for next May delivery. Our experience with the cans bought of you the last year is so satisfactory, that we intend to give you our business in the future. Your cans have done well in the year's service, and, so far as we can see, they are as good as when built, material and workmanship on same being thoroughly honest and good evidence that you intend to remain permanently in the business, and do good, fair, square work.

BOHLEN-HUSE MACHINE & LAKE ICE CO.

SEE TESTIMONIALS NEXT ISSUE.



GROUND FLOOR SPACE 110 X 210 FT.

Established 1861. Incorporated 1890.

THE

KIECHLER MFG. CO.

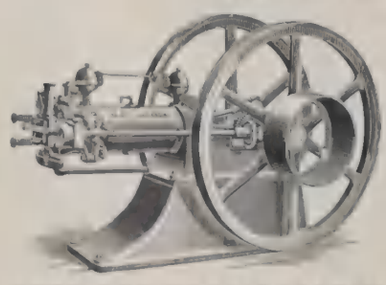
LINN, EVERETT and CLINTON STS.

CINCINNATI, O.

OTTO

Gas and Gasoline Engines

OVER 3300 IN USE



BEST AND CHEAPEST POWER FOR

Refrigerating Machines

No Skilled Attendance.
No Boiler, Heat or Danger.
Started at once for short or long duty.
Sizes, ½ to 100 horse-power.
Can be used in country or city.

OTTO GAS ENGINE WORKS, 33d and Walnut Sts., PHILADELPHIA. 151 Monroe St., CHICAGO.

THE HEERDEGEN WATER INDICATOR

We make investigations for subterranean water and furnish reports as to the number of streams, their exact width, direction of flow, approximate depth below the surface, and quantity of flow.

The great advantage of having a well located, is:

1. We locate wells only at such places where we find subterranean FLOWING streams: this is a full guarantee of getting wells, which will never drop off or give out in time of drought, which is the case where wells are supplied by seepage water only.
2. We can follow the course of a subterranean stream for any distance and select the proper place to sink the well.
3. We state the approximate depth of the stream below the surface, which enables our customers to make an estimate of the cost for sinking the well by the foot.
4. Where the supply of an ARTESIAN WELL is obtained from a running stream or a spring, instead of seepage water, in NINE CASES OUT OF TEN IT IS OF GOOD QUALITY.
5. If there are any springs in the neighborhood where a well is wanted, we can trace the underground outlets of same or the supplying flow for any distance.
6. Where water of low temperature is wanted for cooling purposes, such as for BREWERIES, ICE FACTORIES, distilleries, oil refineries, etc., none cooler than artesian well water exists.
7. Our method of locating wells eliminates all and every risk of failure.

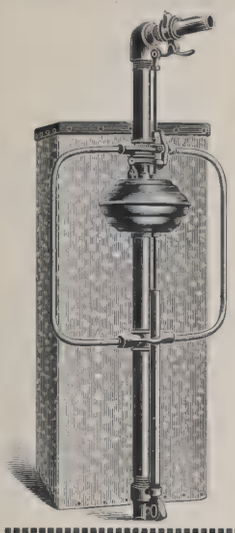
Estimates are given for sinking wells, with guarantee of water, where supply from artesian wells is desired.

We have successfully located a large number of wells.

For particulars apply to

HEERDEGEN & SCHNEE,

48 EXCHANGE PLACE, - - - NEW YORK.



E. C. SAULS. C. G. SAULS.

SAULS BROS.

MANUFACTURERS OF

Sauls' Automatic Ice Can Filler

Fills Automatically and prevents flooding the bath. Save time, labor and money. Over

: : 150 : :

In use in prominent factories. Send for testimonials and prices.

SAULS BROS.

COLUMBUS, GA.

SEIBEL-SUESSDORF

COPPER AND IRON MFG. CO.

MANUFACTURERS OF

Sheet Iron Tank Work

FOR ICE FACTORIES, PACKERS, ETC.

Also Manufacturers of Galvanized Iron . . .

ICE CANS

SEND FOR ESTIMATES.

N. E. CORNER SECOND AND LOMBARD STREETS.

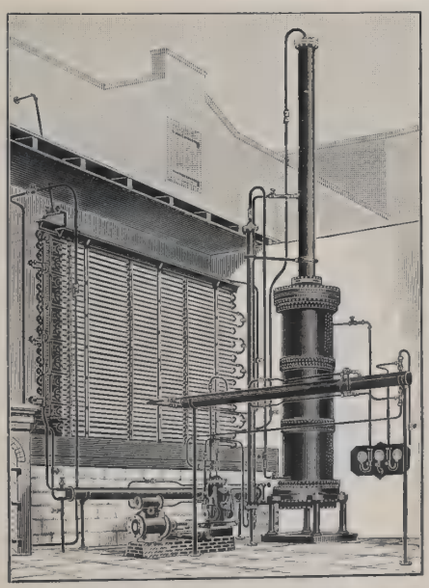
ST. LOUIS, MO.

PENNSYLVANIA IRON WORKS COMPANY,

.....MANUFACTURERS OF....

Ice AND Refrigerating Machines

EMBODYING THE LATEST IMPROVEMENTS IN ABSORPTION MACHINES.



Ice Machine References

W. H. RAGAN, Thibodaux, La.
HENRY COOK, Donaldsville, La.
GEO. & J. G. MUEHLEBACH, Kansas City, Mo.
LAUER BREWING CO., Reading, Pa.
STEGMAIER & SON, Wilkes Barre, Pa.
J. H. MICHENER & CO., Philadelphia, Pa.
EDSON BROS. Cold Storage, Philadelphia, Pa.
"GLADSTONE" APARTMENTS, Philadelphia, Pa.
THOS. BRADLEY, Cold Storage, Philadelphia, Pa.
FRAISSI & BLUM, Ice Manuf'rs, Houma, La.

AND MANY OTHERS.

SATISFACTION AT LOWEST COST GUARANTEED.

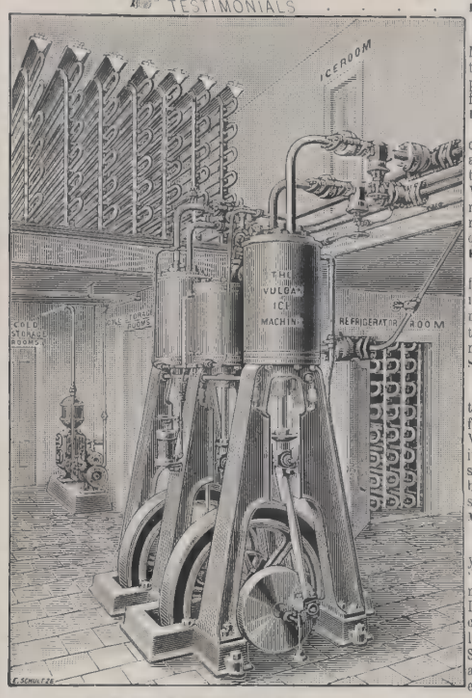
Plans and estimates for plants erected ready for operation cheerfully given on application.

Office and Works, 50th Street and Merion Avenue,

PHILADELPHIA, PA.

The "VULCAN" Ice and Refrigerating Machine.

TESTIMONIALS . . . . . .



ENTERPRISE BREWERY, San Francisco:
"The 24-ton Refrigerating Machine has been running continuously since 1887, and has proved economical and satisfactory in every respect."

HOTEL DEL MONTE, Mont'y:
"The Ice Machine now in operation at Hotel Del Monte is and has been since its completion a very satisfactory plant. We take pleasure in cordially recommending this variety of machine to any who may require its use."

HOTEL RAFAEL, San Rafael:
"The 'Vulcan' Ice and Refrigerating plant is satisfactory in every respect, and is doing more work than was guaranteed. A model of good workmanship. The ice is clear."

SOUTH SAN FRANCISCO PACKING & PROV. CO.:
"It gives us pleasure to state that the Refrigerating plant furnished by the Vulcan Iron Works for our packing house, in 1886, has been in operation since then, and has given the best results, to our complete satisfaction."

MILK RANCH, Penn's Grove, Cal.:
"We have been for the past year, and are now using, a 'Vulcan' Refrigerating Machine, manufactured by the Vulcan Iron Works, for the purpose of cooling from 800 to 1,000 gallons of milk per day, shipped to San Francisco and San Rafael, and find the work done by it entirely satisfactory."

THE VULCAN IRON WORKS, 135-145 Fremont St., San Francisco, Cal.

WINGATE & MELL,

MANUFACTURERS OF : : : **ICE CANS**

WRITE FOR ESTIMATES.

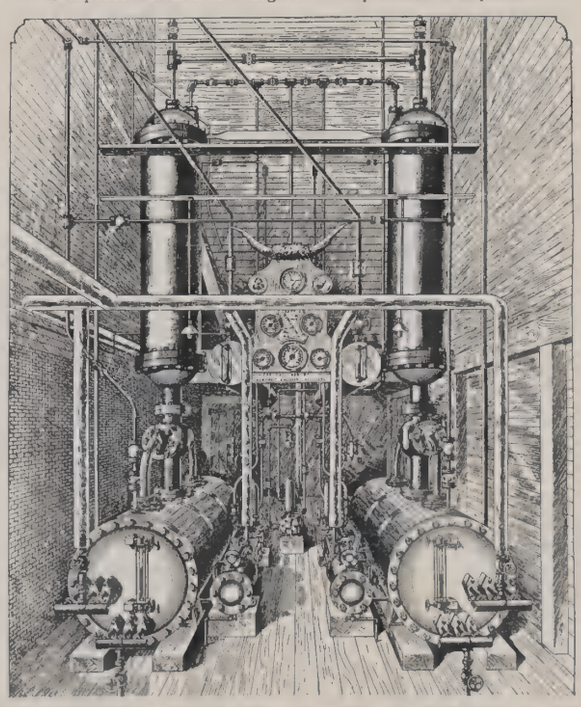
44 & 46 North Broad Street, **ATLANTA, GA.**

Ice AND Refrigerating Machines

FOR . ICE-MAKING . PLANTS

Brewers, Pork Packers, Oil Refiners, Cold Air Store Houses, and all Purposes where a low degree of temperature is required.

Builder of Machinery for Packers, Butchers and Produce Dealers.



Dealer in Engines, Boilers, Pumps and Steam Specialties.

ENGINEER AND CONTRACTOR

Descriptive Circulars, References, Detailed Estimates and Information furnished on Application . . . . . .

JAMES B. CRAFT, 74 CORTLANDT ST. NEW YORK.

GIFFORD BROS.

HUDSON, NEW YORK.

ICE

ELEVATING
CONVEYING
LOWERING

Send for Catalogue and Price List.

MACHINERY

ALSO

CHAIN, FORGINGS, ENGINES AND BOILERS.

STROMBERG, ALLEN & Co.

RAILROAD AND COMMERCIAL

PRINTERS

ENGRAVERS
LITHOGRAPHERS
ELECTROTYPERS

PRINTERS OF
ICE AND REFRIGERATION

- - - - MANUFACTURERS OF - - - -

LIGHT RAILROAD SUPPLIES

Consecutively Numbered Tickets, Bonds, Checks, etc., a specialty

337 AND 339 DEARBORN ST., CHICAGO

ICE MACHINES

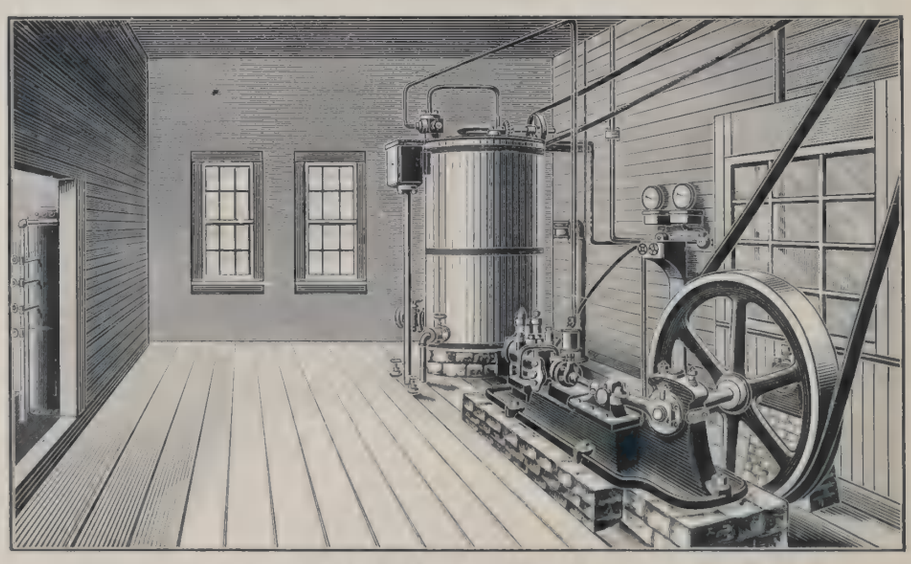
(WINDHAUSEN'S SYSTEM.)

AINSLIE, COCHRAN & CO.

LOUISVILLE, KY.

To the Trade . . . .

We have recently secured the sole right to manufacture and sell WINDHAUSEN'S CARBONIC ANHYDRIDE ICE AND REFRIGERATING MACHINES in the United States. These machines have gained a wide reputation on the continent for their simplicity, durability and economical running. They have been indorsed by the German government, an eighty (80) ton machine having been placed in the powder works at Spandau. They are also fast superseding other systems in the prominent breweries of Germany, nearly 200 being in operation already. They are the only machines using carbonic anhydride which has such a great range of expansion, produces such intense cold, and is cheap, odorless and easily obtained.



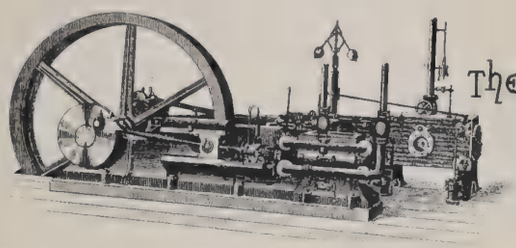
The above cut represents the No. 2 Machine at the Terre Haute House, Terre Haute, Ind.

WRITE TO US FOR FURTHER PARTICULARS

AINSLIE, COCHRAN & CO.

REFRIGERATING PLANTS

THEO. D. VILTER, Prest. & Supt.
ALBERT WALLBER, Vice Prest.
WM. D. VILTER, Secy. & Treas.



The Weisel & Vilter Mfg. Co.

Manufacturers of

CORLISS ENGINES,
Machinery for Brewers and Bottlers.

ICE MAKING & REFRIGERATING MACHINERY.

ICE-MAKING PLANTS

Direct Expansion or Brine System

FOR BREWERIES, PACKING HOUSES, CONFECTIONERIES, COLD STORAGE HOUSES, ETC.

MILWAUKEE, WIS.

Van Winkle Gin & Machinery Co.

E. VAN WINKLE, President.
J. WALLACE BOYD, Secretary.

MANUFACTURERS OF

THE KEELING ..AUTOMATIC.. ICE MACHINE

FOR ICE MAKING, COLD STORAGE PLANTS, BREWERIES, PACKERS, ETC.

WRITE FOR ESTIMATES AND FURTHER INFORMATION.

VAN WINKLE GIN AND MACHINERY CO.

OFFICE, 210 MARIETTA STREET, ATLANTA, GA.

The American Ice Machine Company

SOLE OWNERS OF THE
KLINE AND WINKLER AUTOMATIC

REFRIGERATING AND ICE MAKING MACHINE SYSTEM



Simplicity of Construction,
Durability,
Efficiency,
Economy.

ICE-MAKING OR REFRIGERATING PLANTS

From One Ton to Two Hundred Tons daily capacity.

Over 100 MACHINES IN OPERATION.

1. **The simplicity of construction. Every part is simple and complete,** is exposed to full view, easily got at and can be readily understood and handled by an engineer of ordinary intelligence.

2. **The freezing process is completely automatic** (WHICH NO OTHER FREEZING SYSTEM POSSESSES), through the action of our patent evaporation pressure regulator; it saves valuable working time. Every part is independent of the other, and can be overhauled or replaced without stopping the whole machine.

3. **That ice is manufactured from distilled water,** which is free from disease-producing germs, such as abound in ice frozen on rivers and ponds, is chemically pure, and is infinitely preferable to the natural product.

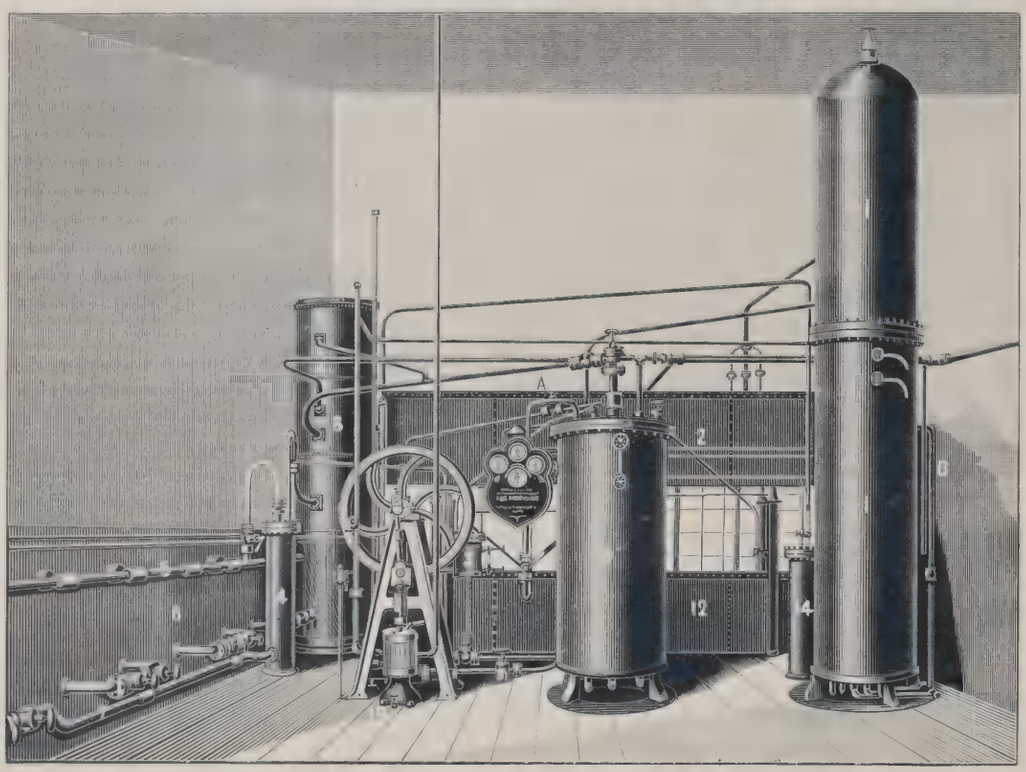
4. **Our Patent Gas Condenser enables us to work with warmer water and less water** than any other machine, as the water is applied DIRECT on the hot pipe without waste or slop on the surroundings.

5. **We can make more ice or cold air** than any other machine, WITH THE SAME AMOUNT OF FUEL. Experts have placed the difference in our favor at not less than 25 per cent.

6. **The Condensers and Freezers** will not stop on account of sediment. They never require cleaning. They clean themselves while at work without separate attachment. Our freezing coils are so constructed that no pipe joint is used inside of the tank, and each coil is independent of the other. Each coil section can be taken out while working without interference with the other sections.

Company's Offices, 35 Broadway, Rooms 72, 73, 74 and 75, New York.

COLUMBUS IRON WORKS IMPROVED Absorption Ice Machine



SUCCESSORS TO
H. D. STRATTON & CO.

Established 1853.
Incorporated 1856.

W. R. BROWN, President.
W. COOK, Superintendent.

Machines from 5 to 33 tons capacity per 24 hours, or larger if desired.

94 Machines Built
and all in successful operation.

More Ice Making Machines sold in the South than by any other establishment.

No expensive building required. No pressure on machine when stopped.

Send for price list and illustrated circular with location of machines.

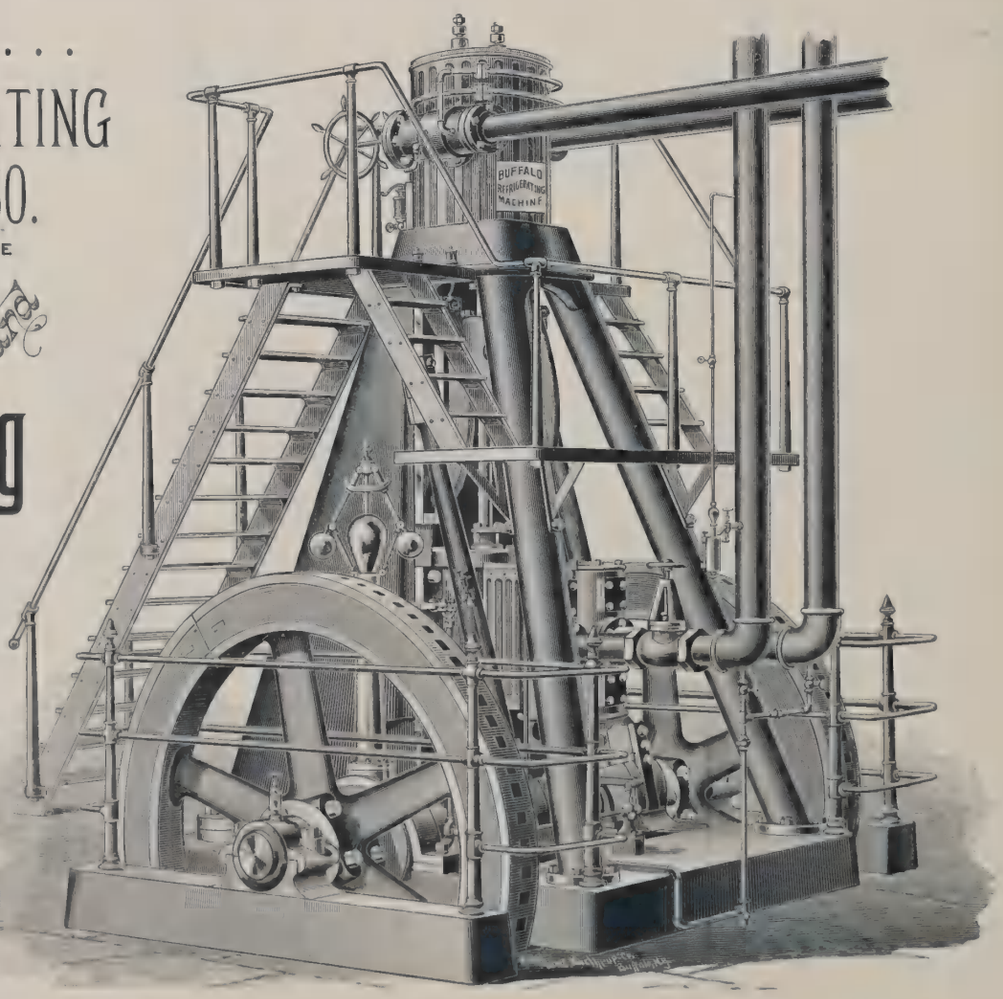
This establishment was the first to turn out a perfect and complete Ice Machine, and has been in the business 21 years, constantly manufacturing and improving, and are prepared to furnish the most reliable and economical machine in the market.

BUILT BY THE . . . **COLUMBUS IRON WORKS CO.** COLUMBUS, GA.

BUFFALO .... REFRIGERATING MACHINE CO.

BUILDERS OF THE

Buffalo Ice and Refrigerating MACHINE



For Ice Making and Artificial Refrigerating

Full particulars, Estimates, Illustrated Circular, containing list of machines in use, etc., furnished upon application.

Buffalo, N. Y.

The Improved Pontifex-Wood Machine

A MOST ECONOMICAL AND RELIABLE APPARATUS.

Adapted to all classes of Refrigeration, especially where extremely low temperatures are required.

ALSO FOR

MAKING . . . ICE

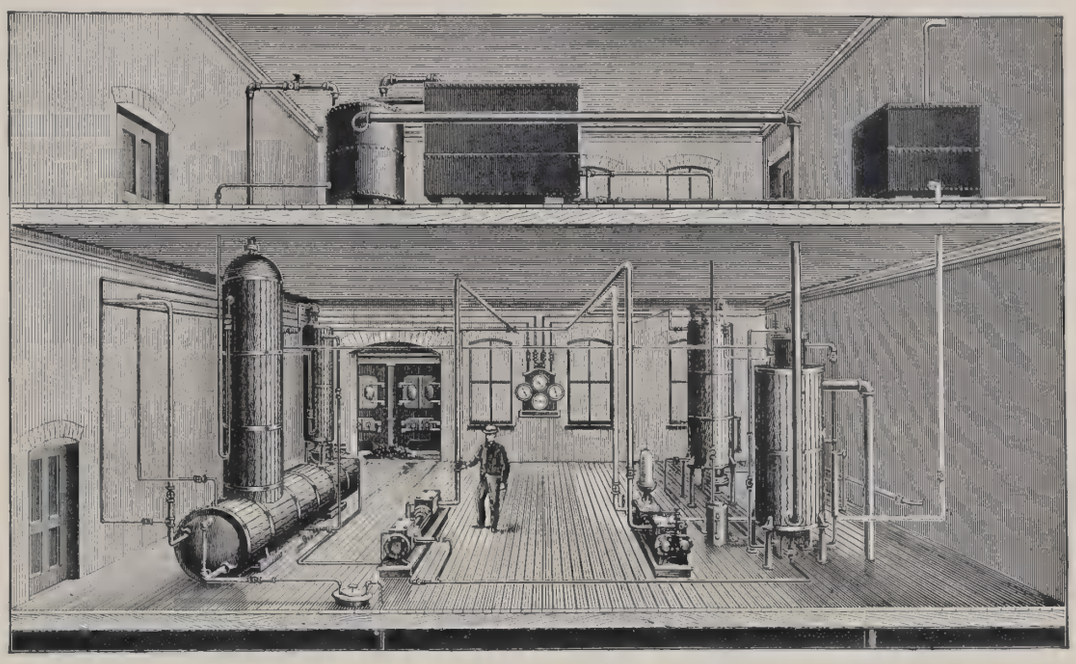
UPWARDS OF

400

MACHINES IN OPERATION.

H. J. W. S. COOKE,
Patentee.

ESTIMATES FURNISHED.
SEND FOR CIRCULARS.



ISBELL-PORTER COMPANY, BUILDERS,

OFFICES

245 BROADWAY, NEW YORK. 46 BRIDGE STREET, NEWARK, N. J.

THE RICHMOND ICE MACHINE CO.

MANUFACTURERS OF

THE

MOST IMPROVED

ON THE COMPRESSION PLAN.

Ice-Making and Refrigerating Machinery

A WORD IN YOUR EAR

OUR MACHINES ARE GIVING SATISFACTION AND MAKING THE GUARANTEED AMOUNT OF PURE, SOLID, TRANSPARENT ICE. . . . . .

We have undoubtedly the BEST and SIMPLEST Machine on the Market.

We guarantee the proper working of our machinery. All working parts built to gauge, so they can be readily duplicated, and nothing but the very best material used. Specifications and estimates furnished.

CORRESPONDENCE SOLICITED.

OFFICE, 1105 MAIN STREET,

WORKS . . . .
MANCHESTER, VA.

P. O. BOX 315. **RICHMOND, VA.**

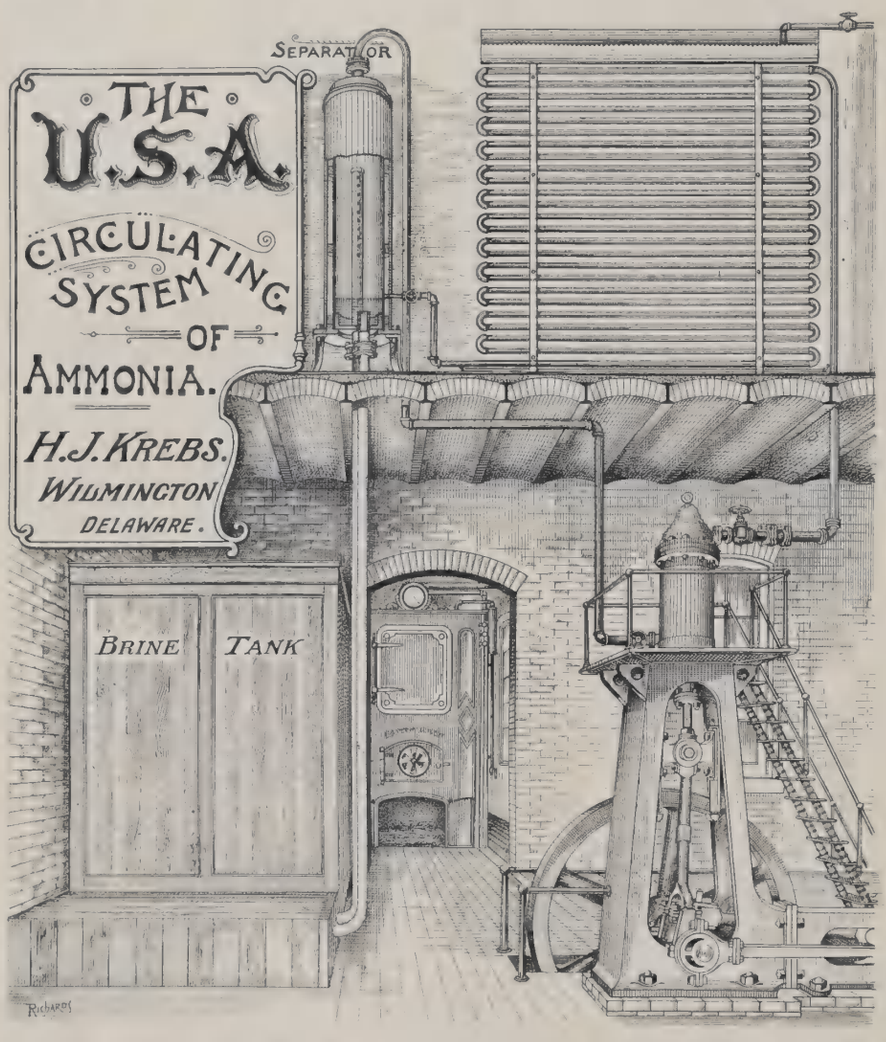
Send for our pamphlet "HOW TO MAKE AN ICE FACTORY PAY."

H. J. KREBS'

U. S. A. Circulating System of Ammonia

PATENTED SEPTEMBER 9th, 1890.

THE results achieved by this system, both for brine cooling and ice making, are unexcelled. It ensures dry gas to the pump and abundance of feed to the expansion pipes, therefore economy in piping, economy in ammonia and economy in space. It is simple and easily operated and saves time, money and worry. You cannot afford to do without it.



In Ordering Machines Specify the

·U·S·A·

CIRCULATING SYSTEM.

DURING LAST YEAR IT WAS INTRODUCED WITH GREAT SUCCESS IN THE FOLLOWING ESTABLISHMENTS:

Charles W. Street, Packing House, Baltimore, Md.
Washington Abattoir Co., - Bennings, D. C.
New Abattoir, Philadelphia Stock Yards, Philadelphia, Pa.
Wilmington Abattoir and Cold Storage Co., Wilmington, Del.
J. P. Bell & Sons, Ice Factory, - Norfolk, Va.

These Plants were Erected by Mr. J. C. Mustard, of 1818 N. 17th St., Philadelphia, Pa.

WRITE FOR PARTICULARS TO

H. J. KREBS,
MANUFACTURER,
WILMINGTON, DELAWARE.

J. C. MUSTARD,

1818 North 17th Street, Philadelphia, Pa.

BUILDER OF

ICE MAKING AND REFRIGERATING MACHINES

DURING LAST YEAR I HAVE ERECTED THE FOLLOWING PLANTS:

∴ REFRIGERATING . MACHINES ∴

N. Auttle, Pork Packer,	Washington, D. C.	Big Elk Dairy,	Oxford, Pa.
C. Spuck, Sausage Maker,	Baltimore, Md.	West Chester Dairy,	West Chester, Pa.
David Eichner, Pork Packer,	Baltimore, Md.	Chas. W. Street, Packing House,	Baltimore, Md.
J. F. C. Hansen, Pork Packer,	Baltimore, Md.	Washington Abattoir Co.,	Bennings, D. C.
Jos. J. Martin, Brandywine Dairies,	Cossart, Pa.	Wilmington Abattoir and Cold Storage Co.,	Wilmington, Del.
R. W. Downing, Wallingford Dairy,	Wallingford, Pa.	New Abattoir, Philadelphia Stock Yards,	Philadelphia, Pa.
H. B. & E. A. Pugh, Dairy,	Oxford, Pa.		

∴ ICE . PLANTS ∴

J. S. Bell & Sons, Ice Factory, Norfolk, Va. Suffolk Ice Co., Suffolk, Va.

The last named plant I am now about starting, having changed it from absorption to compression. A number of above plants are fitted with the U. S. A. Circulating System, which for efficiency, economy, and simplicity cannot be surpassed. My long experience in the ice and refrigerating trade enables me to select the best, and I take especial pride in furnishing high grade machinery at moderate cost.

J. C. MUSTARD,

1818 North 17th St., Philadelphia, Pa.

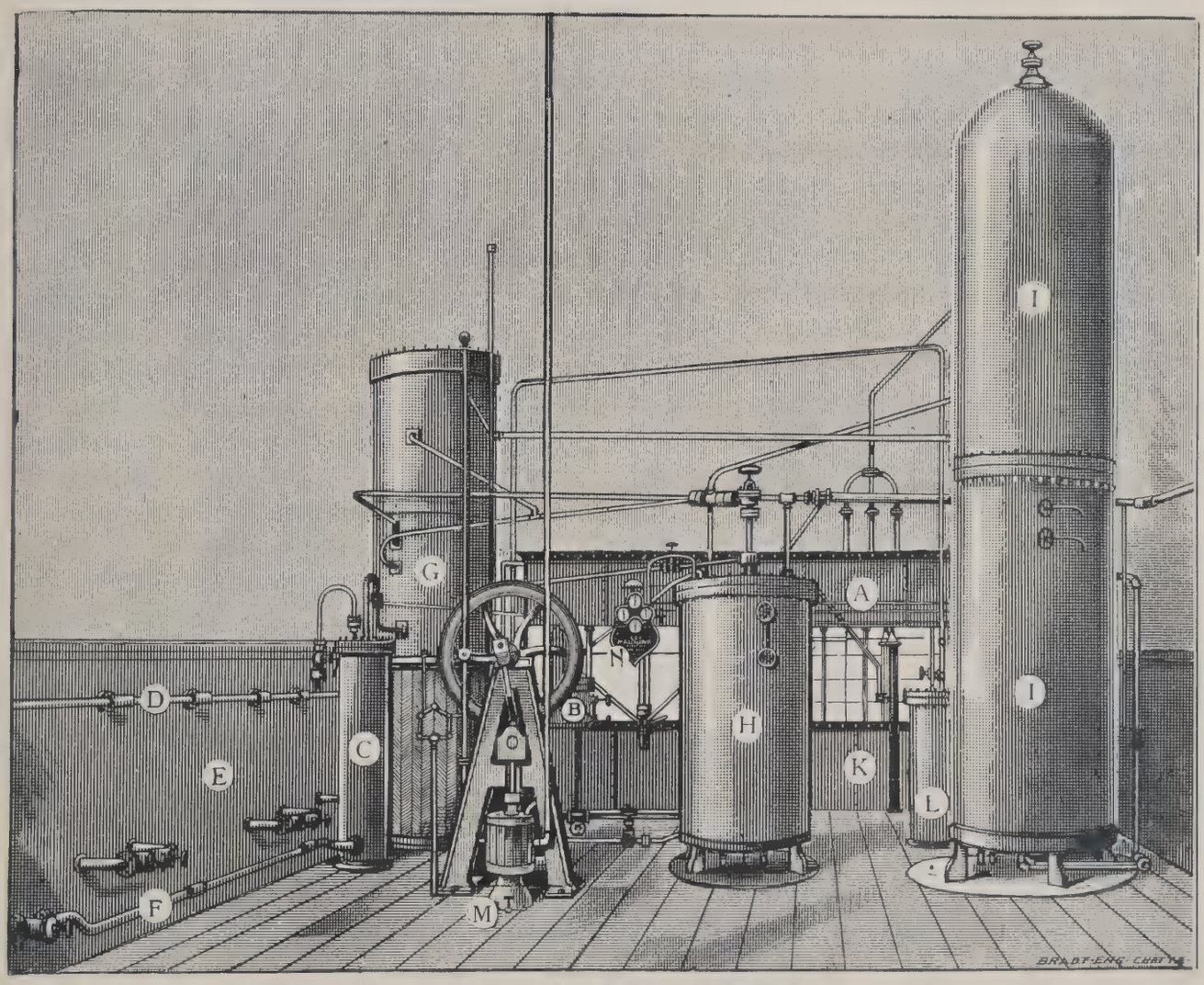
CORRESPONDENCE SOLICITED.

SOUTHERN ICE MACHINE CO.

SOLE OWNERS AND MANUFACTURERS OF

· · · The Latest Improved Absorption · · ·

ICE AND REFRIGERATING MACHINE.



∴ THE SOUTHERN ∴

The SOUTHERN ICE AND REFRIGERATING MACHINE is one of the best and has been acknowledged by the most experienced ice manufacturers to work more economical and produce ice cheaper and of a better quality than any other machine on the market to-day

ALL MACHINES NOW IN OPERATION ARE GIVING PERFECT SATISFACTION.

FOR ESTIMATES AND FURTHER PARTICULARS ADDRESS THE

SOUTHERN ICE MACHINE CO.

CHATTANOOGA, TENN.

THE DE LA VERGNE REFRIGERATING MACHINE CO.

MANUFACTURERS OF

Foot of East 138th Street (Port Morris.)

NEW YORK, U. S. A.

REFRIGERATING AND ICE MACHINES AND ANHYDROUS AMMONIA . . . .

Over

360

Machines are now in Successful Operation, Representing a Total Capacity Equal to the Melting of over

18,000

Tons of Ice Per day.



Machines are used for the Cooling of

Breweries, Abattoirs and Packing Houses, Markets and Cold Storage, Hotels and Restaurants, Chemical Works, Confectioneries, and Chocolate Manufactories, Steamship Holds, Wineries, Dairies,

AND FOR THE MANUFACTURE OF **ICE**

A FULL DESCRIPTION OF OUR SYSTEM AND APPARATUS WILL BE SENT TO PERSONS APPLYING FOR THE SAME.

CORRESPONDENCE FROM PARTIES DESIROUS OF CONTRACTING FOR PLANS IS SOLICITED.

Estimates and Proposals will be promptly furnished free of charge as soon as the requirements are made known to us.

PICTET

Ice and Refrigerating Machine

....MANUFACTURED BY....

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

WE DO NOT USE AMMONIA.

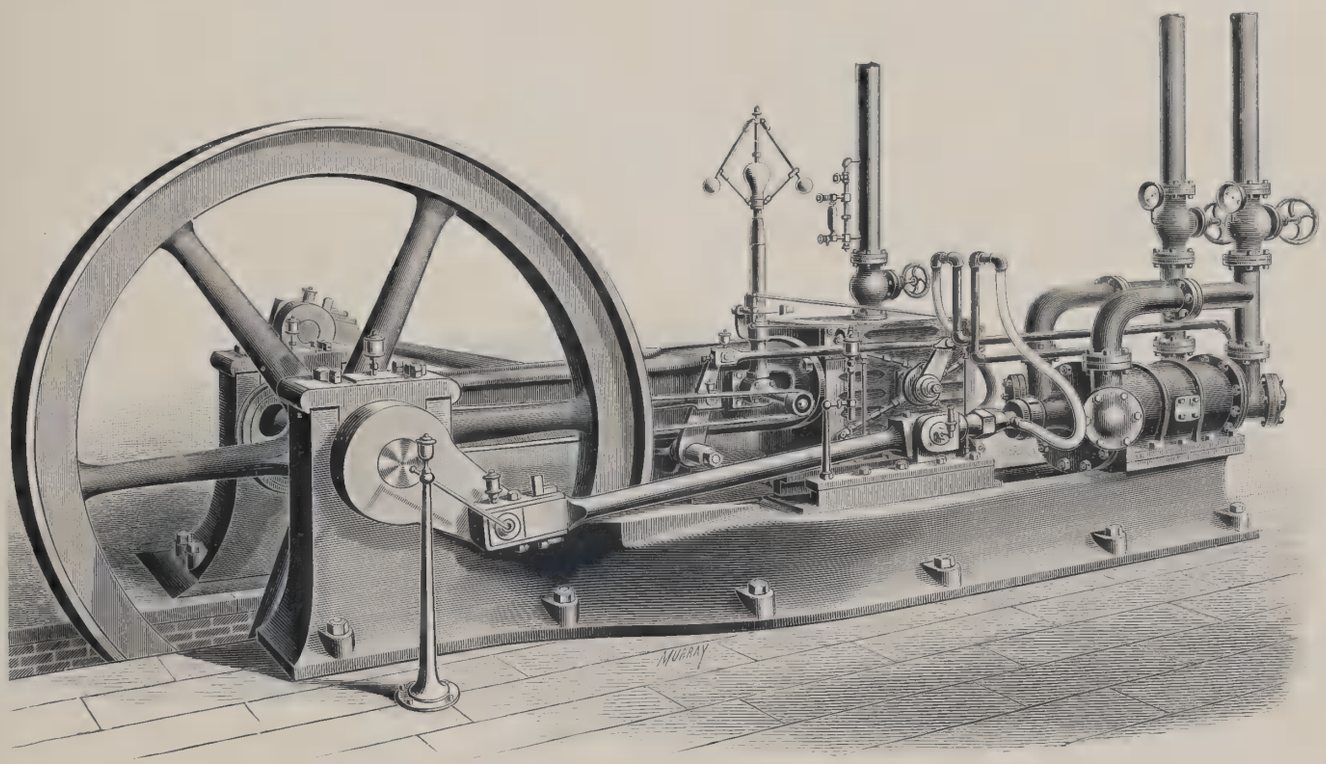
Pictet Machines use **Anhydrous Sulphurous Oxide,** a chemical noted for its low working pressure, is of itself a lubricant, and does not injure any of the metals; its low pressure is a guarantee against explosion.

NEW YORK BOARD OF FIRE UNDERWRITERS.
BUREAU OF SURVEYS
JAMES HARRISON, Supt.
Boreel Building, 115 Broadway, Room 37.

NEW YORK, January 24, 1891.

THE PICTET ARTIFICIAL ICE CO. (Limited), New York:

Dear Sirs: Your favor of the 22d inst. is at hand. In reply, the examination of our expert and his subsequent report were convincing that the article known as Anhydrous Sulphurous Oxide is a safe article for storage or shipment, its tendency being to extinguish rather than to cause fire. Yours truly, JAMES HARRISON, Supt.



Working Pressure from 50 to 75 lbs.

We guarantee GREATER ECONOMY OF FUEL, doing the same amount of work with less coal than any machine in the market.

FOR LIST OF REFERENCES AND FURTHER PARTICULARS, ADDRESS

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

WORKS: NEWBURGH, N. Y.

New York Office, 21 Cortlandt St., Room 6.

FRICK COMPANY

ENGINEERS,

WAYNESBORO, FRANKLIN COUNTY, PA., U. S. A.



5-Ton Machine.

INCORPORATED 1885.

JOSEPH PRICE, President.
SAMUEL HOEFLICH, Vice-Pres.
H. B. STRICKLER, Treasurer.
EZRA FRICK, Secretary.
EDGAR PENNEY, M. E., Gen. Sup.

ESTABLISHED 1853.



MAIN WORKS AND GENERAL OFFICES: WAYNESBORO, PA.

CAPITAL, - - - - - - $1,000,000.

MANUFACTURERS OF THE

ECLIPSE

Ice Making and Refrigerating Machines.

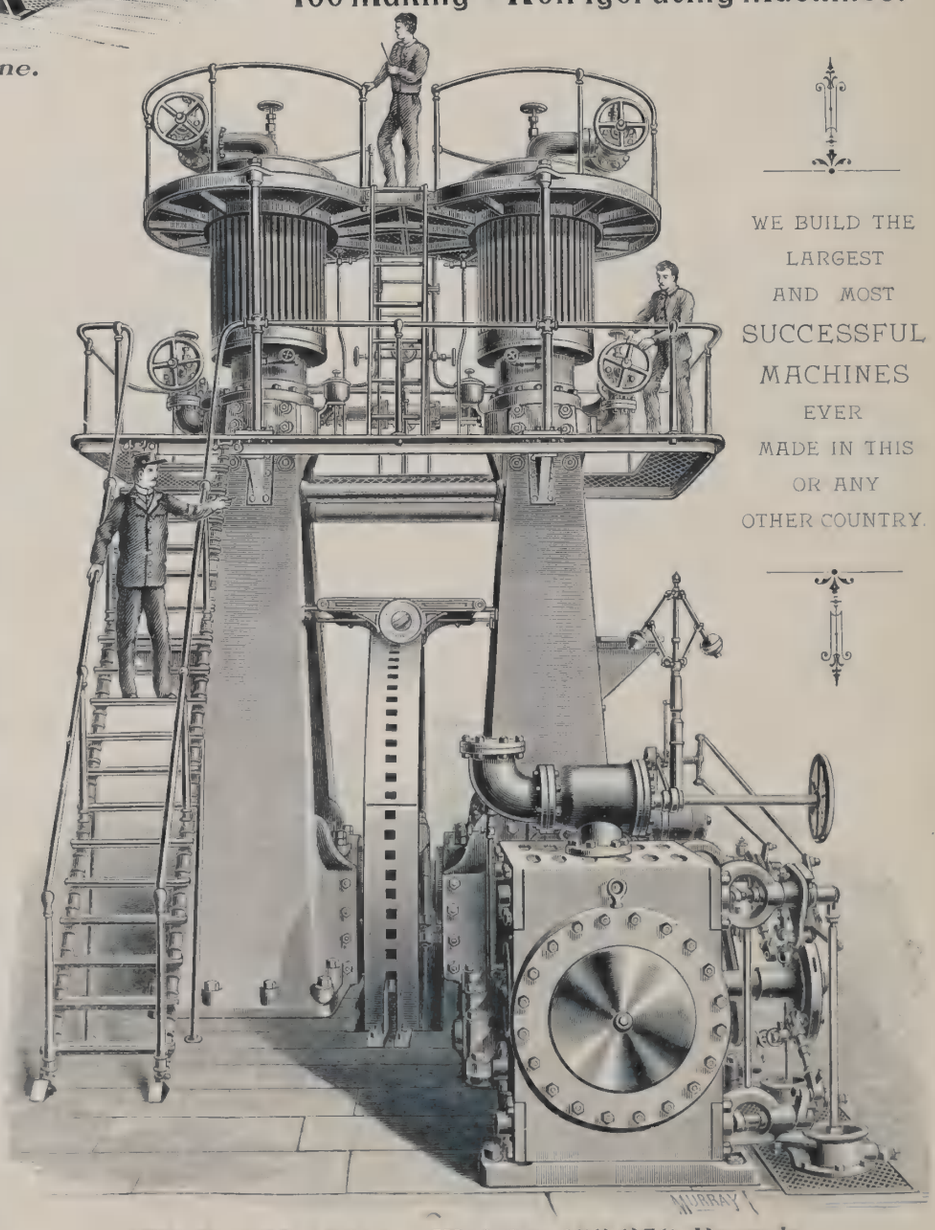
SEND FOR OUR NEW CATALOGUE, 1890.

A Few References:

BREWERIES.	Refrigerating Tons.
Phoenix Brg. Co., Baltimore, Md.	27
Gipps Brg. Co., Peoria, Ill.	50
Sprattler & Mennell, Paterson, N. J.	32
Herman Lackman, Cincinnati.	65
Henry Fink, Harrisburg, Pa.	32
Sebastian Helldorfer, Baltimore, Md.	32
Frank Reisch & Bros., Springfield, Ill.	50
Jos. Stem & Co., Louisville, Ky.	23
Meyer & Reidlin, Covington, Ky.	32
Parkersburg Brg. Co., Parkersburg, W. Va.	27
Bellevue Brg. Co., Cincinnati, O.	50
Cumberland Brg. Co., Cumberland, Md.	27
D. Lutz & Son, Allegheny, Pa.	50
Herman Lackman, Cincinnati (2d order)	80

PACKING AND COLD STORAGE.	
J. C. Shafer & Co., Baltimore	40
G. Cassard & Sons, Baltimore	25
Baltimore City Storage Co., Baltimore	32
Armour Packing Co., Kansas City	100
Shallcross & Son, Coatesville, Pa.	15
Washington Market Co., Washington, D. C.	32
Armour Pckg. Co., Kansas City (2d order)	150
Francis Whittaker & Sons, Wichita, Kas.	150
Emil Winters, Pittsburgh, Pa.	37
Frank Seifrid, Louisville, Ky.	7
Chicago Packing & Provision Co., Chicago	150
Chicago Packing & Provision Co., Chicago (second order)	150
Steelton Store Co., Steelton, Pa.	10
Pittsb'gh Meat Supply Co., Allegheny, Pa.	50
J. Vogle & Son, Cincinnati	30
John C. Hately, Chicago	65
G. H. Hammond & Co., Hammond, Ind.	150
G. H. Hammond & Co., Omaha, Neb.	150
Calumet Canning Co., Hammond, Ind.	32
West Chester Cd. Stor. Co., W. Chester, Pa.	40
Chautauqua Lake Ice Co., Pittsburgh, Pa.	20

ICE FACTORIES.	Ice. Tons.
F. L. Ellis & Co., Hopkinsville, Ky.	10
Consumer Ice Co., New Orleans, La.	100
Little Rock Ice Co., Little Rock, Ark.	35
Owensboro Ice & Cd. Stor. Co., O'sb'o, Ky	20
W. S. Lurton, Jacksonville, Ill.	15
Pulaski Ice Co., Pulaski, Tenn.	5
Armour Packing Co., Kansas City	75
Ewing & Beall, Uniontown, Pa.	15
S. W. Hill, Allegheny, Pa.	18
Chautauqua Lake Ice Co., Pittsburgh.	40
Chautauqua Lake Ice Co., Pittsburgh (2d order)	40
West Chester Ice Co., West Chester, Pa.	15
Steelton Store Co., Steelton, Pa	2
Parkersburg Brg. Co., Parkersburg W. Va.	3
Cumberland Brg. Co., Cumberland, Md.	8
Hagerstown Ice Co., Hagerstown, Md.	20
Alberto Malo City of Mexico, Mex	25
Germantown Ice Co., Germantown, Pa.	20
Bryn Mawr Hotel Co., Bryn Mawr, Pa.	20
Geo. S. Sexton & Co., Wytheville, Va.	5
Cambridge Ice Co., Cambridge, Md.	10

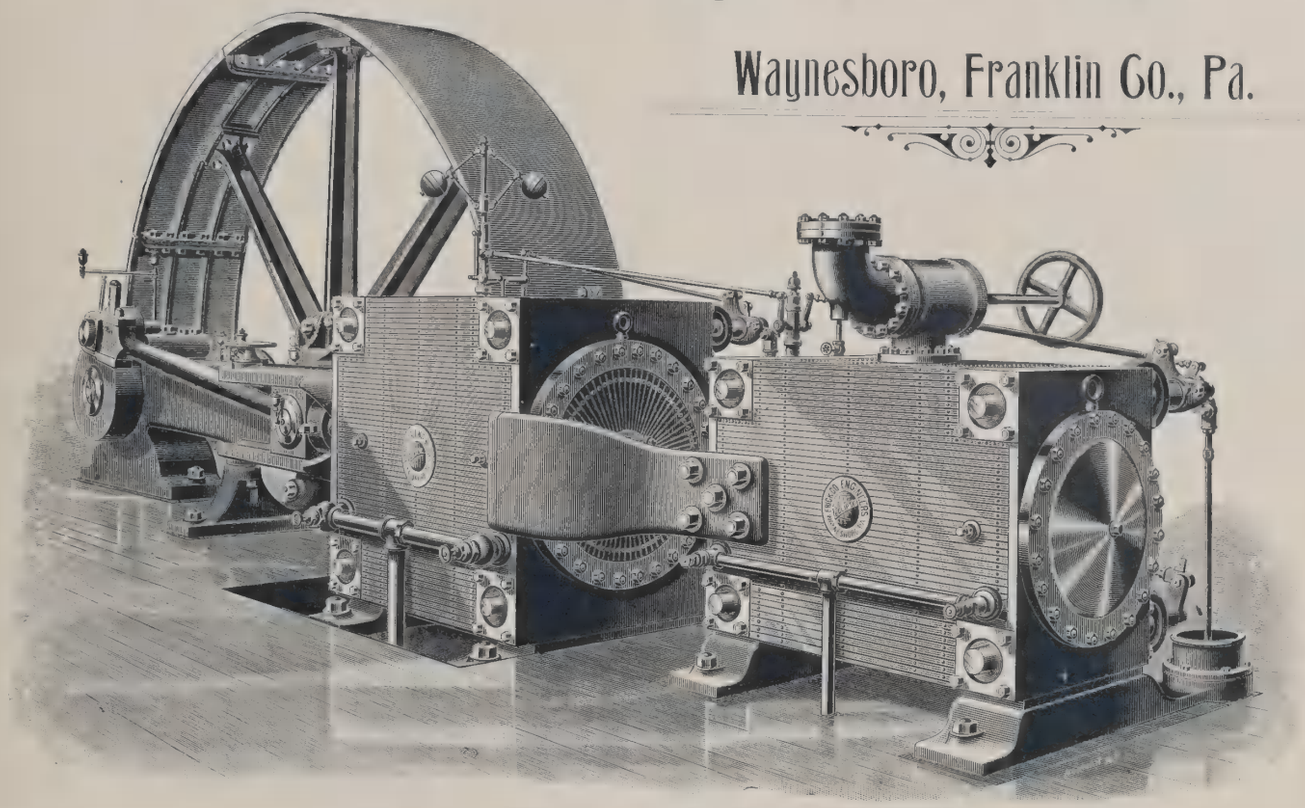


150-Ton Machine. Weight, 193,250 Pounds.

WE BUILD THE LARGEST AND MOST SUCCESSFUL MACHINES EVER MADE IN THIS OR ANY OTHER COUNTRY.

FRICK COMPANY, ENGINEERS,

Waynesboro, Franklin Co., Pa.



A GENUINE CORLISS ENGINE WITH ALL THE LATEST IMPROVEMENTS.

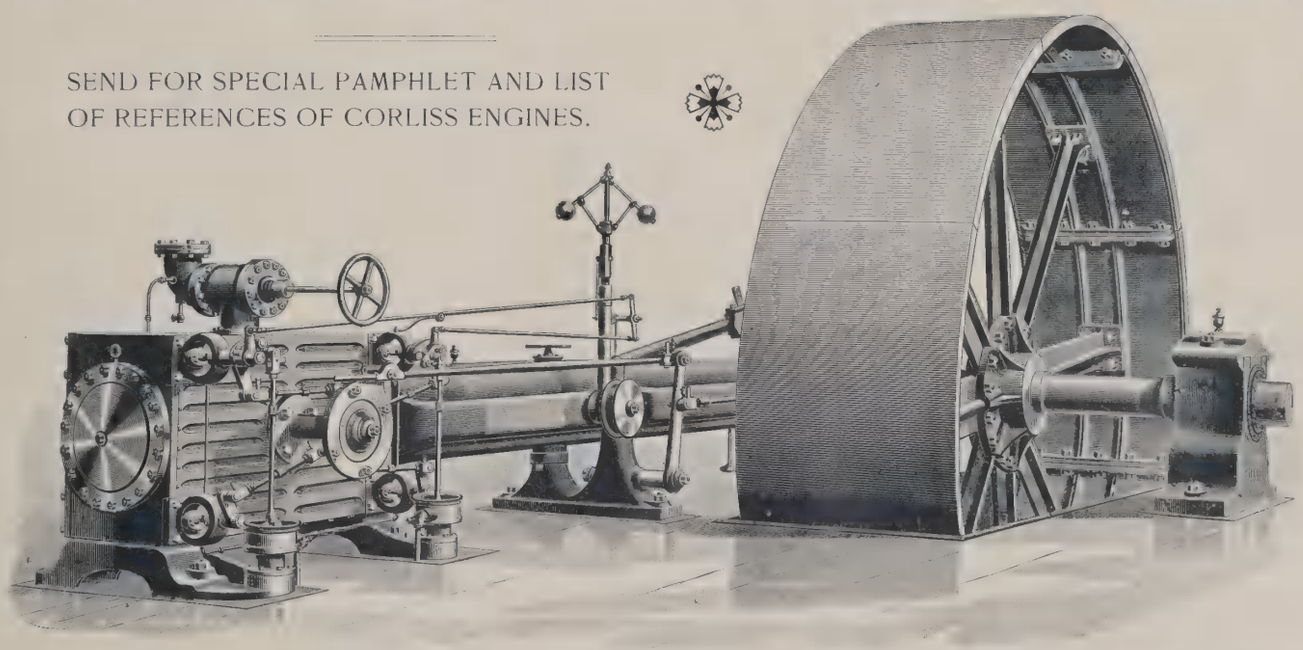
"EGLIPSE" CORLISS TANDEM COMPOUND CONDENSING ENGINE

UP TO 3000 HORSE POWER

We have complete line of patterns and build Corliss Horizontal Stationary Engines, Corliss Vertical Engines, Condensing or Non-Condensing, Single or in Pairs. Corliss Compound Engines, Tandem or Cross Compound. Corliss Engines for any service, 40 to 3000 horse power, in a single engine.

SPECIAL NOTICE—With our Corliss Engine we contract for fitting up complete the entire Steam Plants, including Steam Boiler, Feed Water Heater, Feed Pumps, Piping, Shafting, and all the appurtenances and belongings peculiar to a first-class job.

SEND FOR SPECIAL PAMPHLET AND LIST OF REFERENCES OF CORLISS ENGINES.



1000-HORSE POWER "EGLIPSE" PLAIN CORLISS ENGINE.

THE WILSON-SNYDER MFG. CO.

MANUFACTURERS OF AUGUST SNYDER'S PATENT

Ice and Refrigerating Machine

SPECIALLY DESIGNED TO MEET THE DEMANDS OF ICE MAKERS AND REFRIGERATION IN ALL ITS APPLICATIONS . . . . . .



INTERIOR VIEW OF WORKS OF THE WILSON-SNYDER MFG. CO.

TWO styles of these machines are built: One, single acting compressor, with duplex condensers and brine tanks; the other, duplex compressor, condensers and brine tanks. The special advantages of this machine over all others are as follows: In either the single or duplex machine, either one of the brine tanks or condensers getting out of order, or anything happening to necessitate repair, the system of valves is so arranged as to allow using but one condenser or one brine tank, and the machine is kept running with the disabled part as though nothing had happened, while the disabled brine tank or condenser is being dismantled and repaired. Write for list of machines in operation, references, prices, etc. . . . . .

ALSO MANUFACTURERS OF IMPROVED . . . .

PUMPING MACHINERY

Including AIR PUMPS, BRINE PUMPS, HOT AND COLD WATER PUMPS, BOILER FEED PUMPS, TANK PUMPS, Etc.

Ammonia Valves, Pipe Coils and Pipe Fittings

.....OF EVERY DESCRIPTION .....

PITTSBURGH, PA.

HERCULES

Ice and Refrigerating

MACHINE

(REFRIGERANT: ANHYDROUS AMMONIA.)

FOR

BREWERIES, PACKING HOUSES, COLD STORAGE.

. . . Artificial Ice Plants . . .

DRIVEN BY INDEPENDENT CORLISS ENGINE, WHICH CAN BE USED TO OPERATE OTHER MACHINERY.

Strongest, Most Durable and Most Economical Machine

ON THE MARKET

Our Guarantee is the Highest given by any Company, and Every Machine Sold has Exceeded the Guarantee.

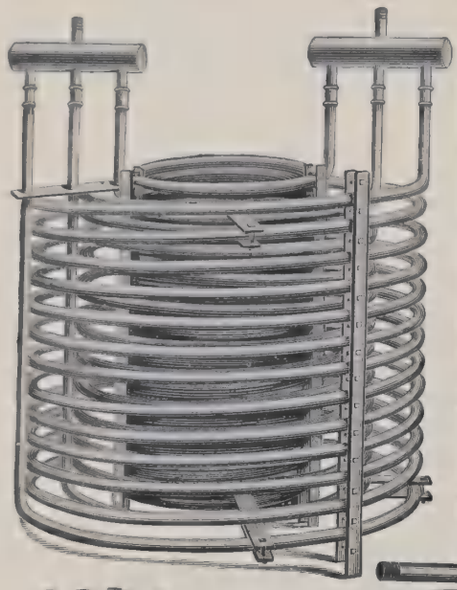
SEND FOR ILLUSTRATED CIRCULAR AND REFERENCES.

THE HERCULES IRON WORKS,

ROOM 502 OWINGS BUILDING,
DEARBORN AND ADAMS STS.

CHICAGO . .

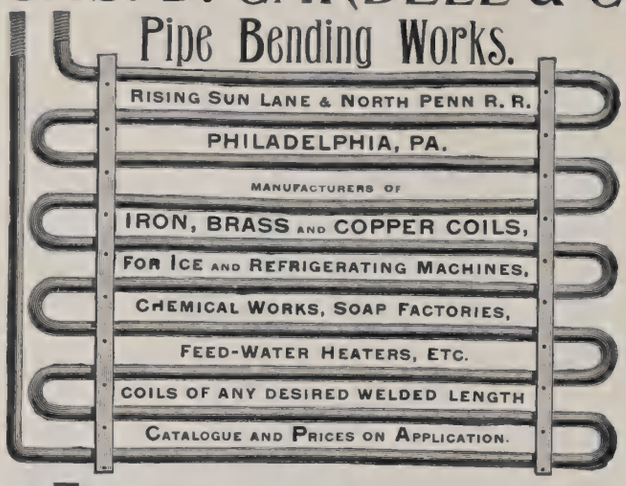
WORKS, AURORA, ILL.



JAMES D. CARDELL. WASHINGTON HOPKINS.

JAS. D. CARDELL & CO.

Pipe Bending Works.



RISING SUN LANE & NORTH PENN R. R.

PHILADELPHIA, PA.

MANUFACTURERS OF

IRON, BRASS AND COPPER COILS,

FOR ICE AND REFRIGERATING MACHINES,

CHEMICAL WORKS, SOAP FACTORIES,

FEED-WATER HEATERS, ETC.

COILS OF ANY DESIRED WELDED LENGTH

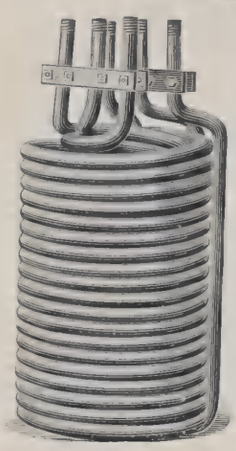
CATALOGUE AND PRICES ON APPLICATION.



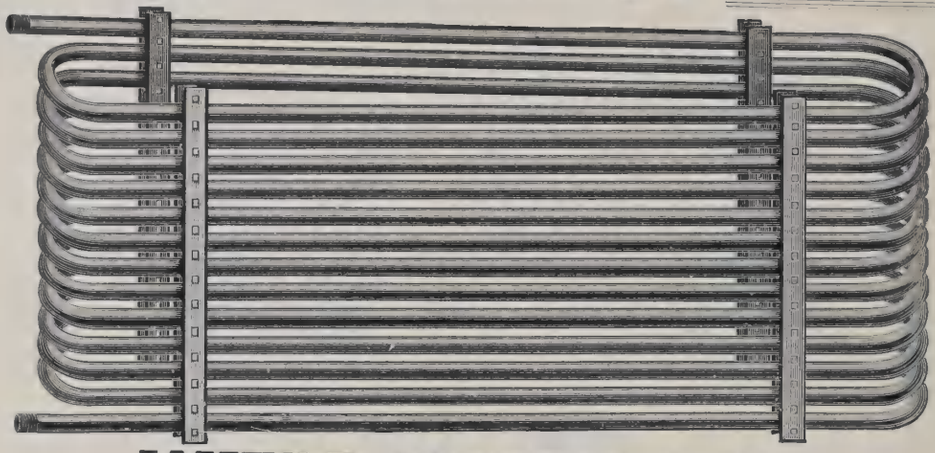
BENDING @

Of Large Sizes Pipe a specialty

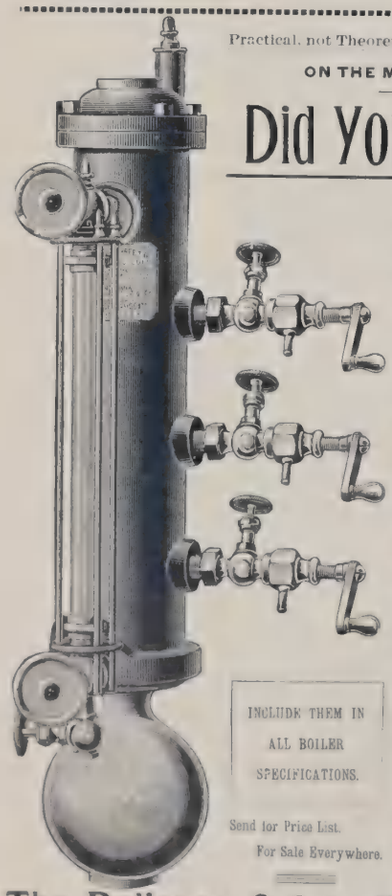
SEND FOR CATALOGUE.



Brine and Condenser Tanks, Ammonia Bottles, Ammonia Valves, Flanges, ETC.



JAMES D. CARDELL & CO.



Practical, not Theoretical . . Over 15,000 in daily use.

ON THE MARKET SINCE 1884.

Did You Ever Stop

to think what it means to have the water carried uniformly at the proper level?

IT MEANS safety, saving of fuel, steady power, and more of it, no leaky tubes, no burned boilers, no stoppage for expensive repairs.

ALL of which

YOU CAN secure for merely nominal cost,

BY USING

INCLUDE THEM IN ALL BOILER SPECIFICATIONS.

Send for Price List.

For Sale Everywhere.

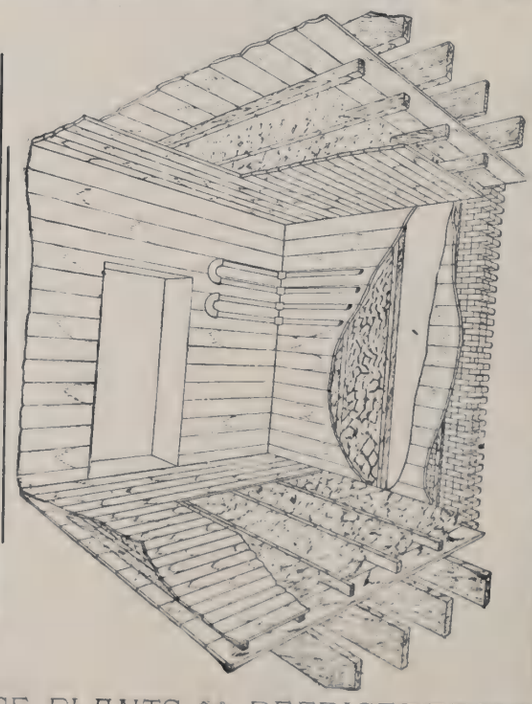
The Reliance Safety Water Columns.

THE RELIANCE GAUGE CO.

101 EUCLID AVE., CLEVELAND, O.

MINERAL WOOL

COLD STORAGE, BREWERIES



INSULATION

ICE PLANTS & REFRIGERATORS.

FOR FREE SAMPLE AND BOOK, ADDRESS

Western Mineral Wool Co.

CHICAGO. CLEVELAND. ST. LOUIS.

Write for Prices on the . . . . . .

CORRUGATED... ... WATER-TUBE **FEED-WATER HEATER**

More Effective and Durable . . . . . .

Than a Coil Heater at the Same Price.

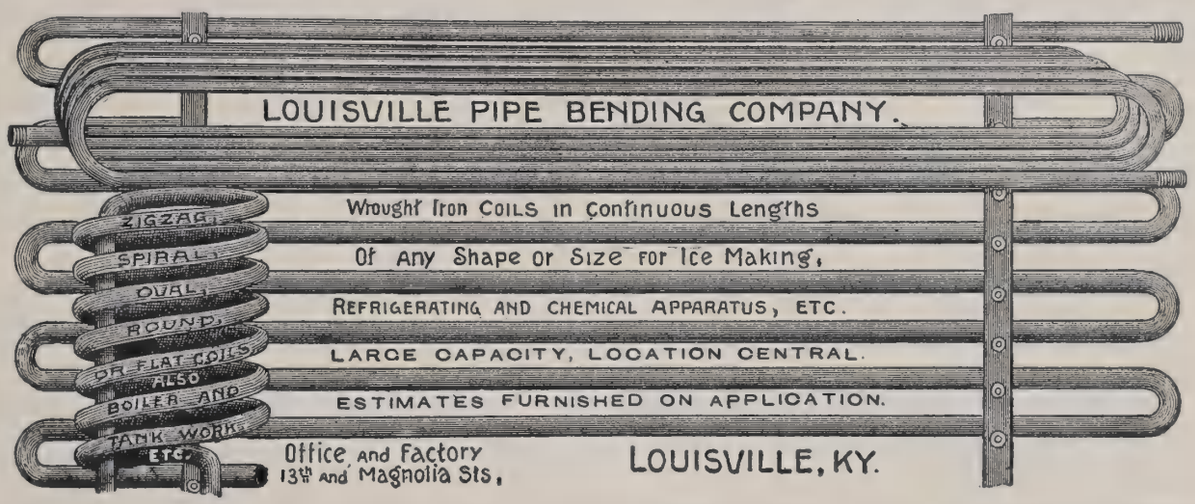
SOLE MANUFACTURERS:

The Wainwright Manufacturing Co. of Mass.

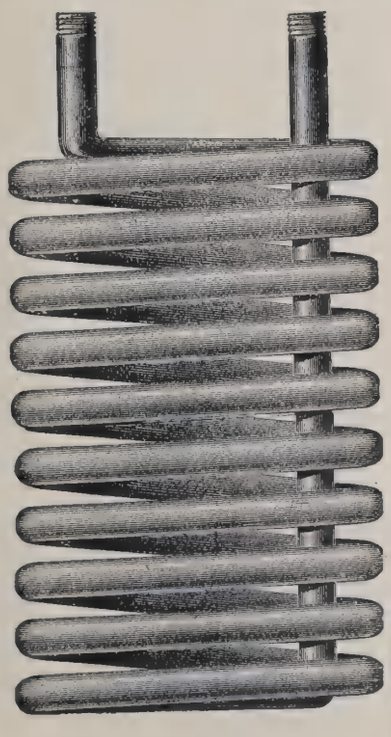
8 Oliver Street, BOSTON.

SEND FOR CATALOGUE I. C.

CHICAGO: 26 West Randolph Street.
NEW YORK: 121 Liberty Street.



THE HARRISBURG PIPE BENDING CO. LIMITED.



WORKS, S. E. CORNER HERR STREET AND PENNSYLVANIA CANAL. HARRISBURG, PA.

.....MANUFACTURERS OF.....

COILS AND BENDS

Of Wrought Iron Pipe . . For Ice Making and Refrigerating

in Round, Oval, Zigzag, Spiral, Helical and Tapering Forms.

CHEMICAL WORKS, FEED-WATER HEATERS,
BLAST FURNACES, EVAPORATING LIQUIDS,
AMMONIA MACHINES, SOAP WORKS, ETC.

IRREGULAR PIPE BENDING A SPECIALTY



AMMONIA BOTTLE.

AMMONIA . BOTTLES . OR . FLASKS . WITH . WELDED . HEADS

STRAIGHT OR CONCAVE

New York Coal Tar Chemical Co.

10 WARREN ST., NEW YORK.

MANUFACTURERS OF

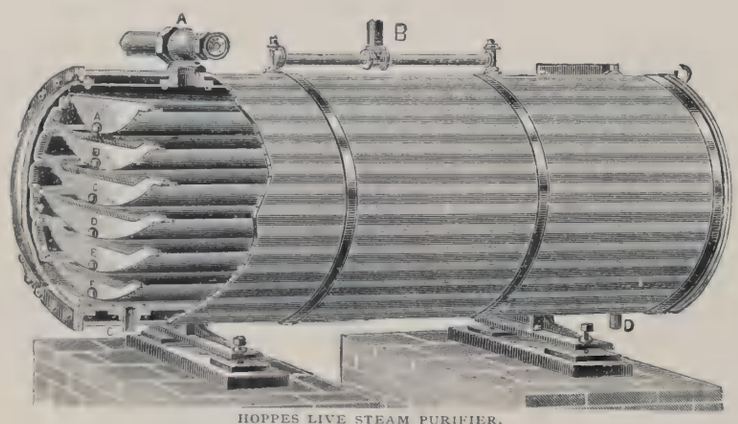
ABSOLUTELY PURE

ANHYDROUS AMMONIA

AND

AQUA AMMONIA

FOR REFRIGERATING PURPOSES.



HOPPES LIVE STEAM PURIFIER.

THE

"HOPPES"

Live Steam Feed-Water

PURIFIER

Is especially adapted to ICE MAKING PLANTS, as pure water is essential to insure a good quality of ICE. The use of the HOPPES PURIFIER will insure you pure water, by removing all of the impurities therefrom, at the same time keeping your boilers clean and free from scale without the use of boiler compounds or scale solvents.

CATALOGUES, ESTIMATES, SPECIFICATIONS, ETC., CHEERFULLY FURNISHED.

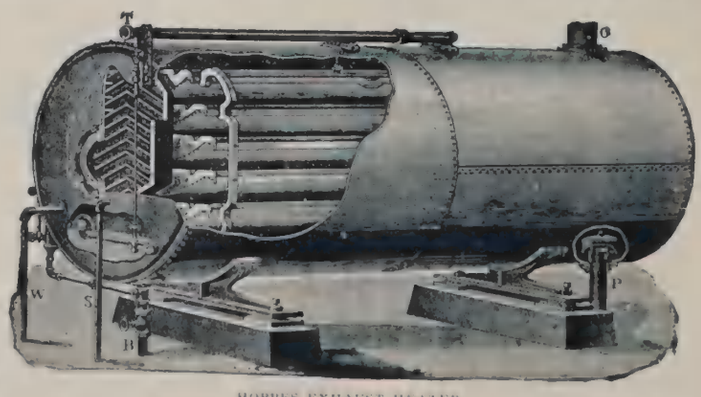
THE HOPPES MFG. CO., SPRINGFIELD, O.

IF YOU WANT TO GET THE FULL BENEFIT OF YOUR EXHAUST STEAM, INVESTIGATE THE

"HOPPES"

Exhaust Steam Feed-Water

HEATER



HOPPES EXHAUST HEATER

The National Ammonia Co.

Our Ammonias are the Recognized Standards of Quality. Use Our Brands and Secure the Best Results with your Machines.

... ABSOLUTELY DRY AND PURE ...

LIQUID ANHYDROUS AMMONIA AND AQUA AMMONIA (ALL STRENGTHS),

For Refrigerating and Ice Machines.

GENERAL OFFICES:--ST. LOUIS, MO.

We are the Largest Manufacturers in the World. Send your Orders to Us and Get Prompt and Satisfactory Service.

Our Ammonia can be had of the following Agents:

NEW YORK—The De La Vergne Refrig. M. Co.
W. M. Schwenker.
Mallinckrodt Chemical Works.
PHILADELPHIA—Theo. J. Goldschmid.
BALTIMORE—Wm. Mitchell.
WILMINGTON—Delaware Chemical Co.
BUFFALO—Kast Copper & Sheet Iron Co.
ST. LOUIS—Mallinckrodt Chemical Works.
Larkin & Scheffer.
CINCINNATI—Herman Goepper & Co.
CLEVELAND—Benton, Myers & Co.
DETROIT—Michigan Ammonia Works.
KANSAS CITY—Henry Menderson.
CHICAGO—A. Magnus' Sons.
Fuller & Fuller Company.
MILWAUKEE—The Chas. Baumbach Company.
SAN FRANCISCO—Herrmann & Company.
PORTLAND, ORE.—Snell, Heitschu & Woodard.

B. P. CLAPP AMMONIA COMPANY,

MANUFACTURERS OF

ABSOLUTELY PURE - - 26° AQUA AMMONIA

Containing 29¼ per cent of Ammonia. FOR REFRIGERATING PURPOSES AND THE TRADE . . . . . .

GENERAL OFFICES:

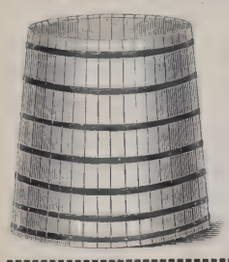
245 BROADWAY, NEW YORK.

THE CLEVELAND ANHYDROUS AMMONIA WORKS

THOS. FLESHER, JR., Proprietor.

MANUFACTURERS OF ...PURE... Anhydrous Ammonia.

70 E. Prospect St., CLEVELAND, OHIO.



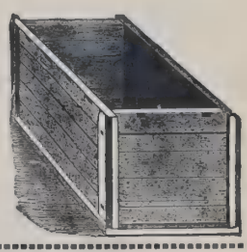
GEO. WOOLFORD, Manufacturer of all kinds of

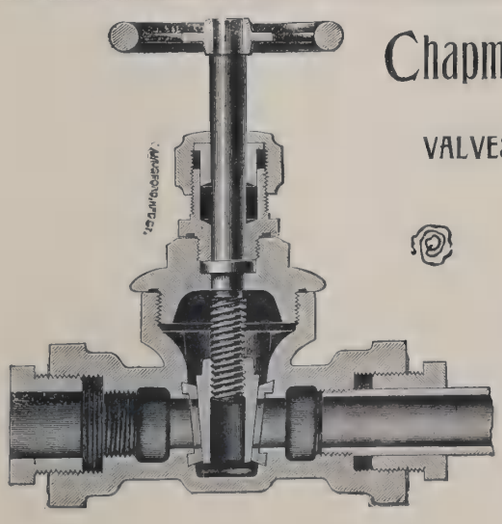
Cedar Vats, Tanks, HOT & COLD Water Tanks, Railroad Tanks

In sending for estimates, state if measurements are inside or outside, and thickness of wood desired . . . . . .

FOR ICE FACTORIES, COLD STORAGE HOUSES RAILROADS, PACKERS, CHEMICAL WORKS, ETC.

2240, 2242 and 2244 North 9th Street, PHILADELPHIA.





Chapman Valve Manufacturing Co.

.....MANUFACTURERS OF.....

VALVES AND GATES FOR WATER, GAS, STEAM, ACID, OIL, AMMONIA, ETC.

ALSO GATE FIRE HYDRANTS

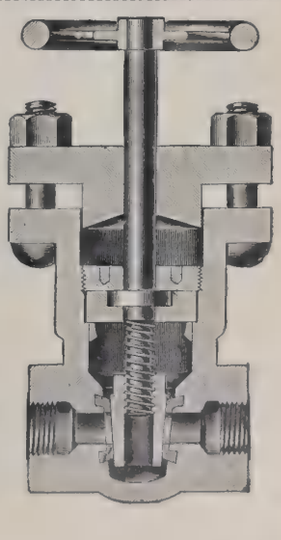
SPECIAL ATTENTION GIVEN TO

VALVES FOR REFRIGERATING, COLD STORAGE, ICE MAKING MACHINERY, ETC.

We make the best Valve for Ammonia Heavy Pressure in the market. The two illustrations here represent Ammonia Valves that are giving universal satisfaction.

General Office and Works, INDIAN ORCHARD, MASS

Treasurer's Office, 72 Kilby and 112 Milk Sts. BOSTON, MASS.



THE LAIDLAW & DUNN CO.

PURCHASERS OF { McGOWAN PUMP CO. / ECLIPSE PUMP MFG. CO.

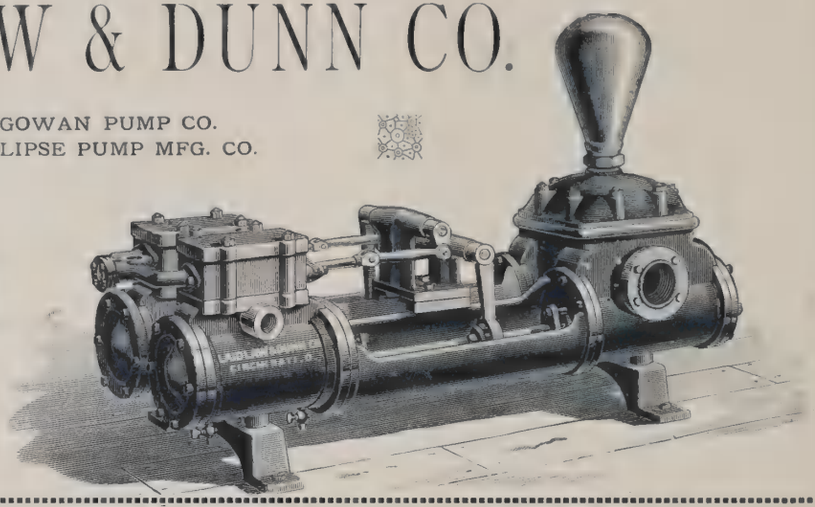
MANUFACTURERS OF

BRINE
WATER
BREWERY

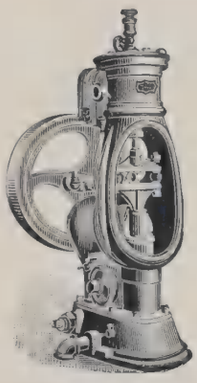
PUMPS

AND PUMPS FOR ALL PURPOSES.

CINCINNATI, OHIO.



AMMONIAL LIQUID . . . . **PUMPS**



FOR USE IN.....

ICE MAKING AND REFRIGERATING PLANTS

These Pumps are made very heavy and guaranteed to work smoothly against 300 pounds pressure to the square inch . . . . . .

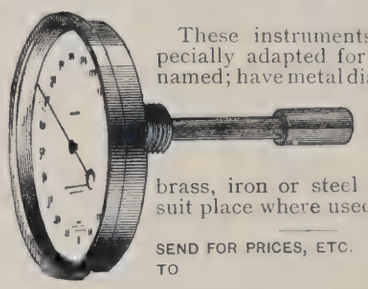
VALLEY PUMP CO.

EASTHAMPTON, MASS.

Standard Thermometers.

FOR USE IN

Ice Machines,
Refrigerators,
Brine Tanks,
Ammonia
Circulating Pipes,
Etc., Etc.



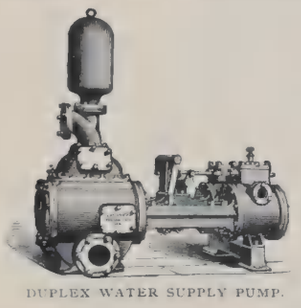
These instruments are especially adapted for purposes named; have metal dials, either brass, iron or steel casing to suit place where used.

SEND FOR PRICES, ETC. TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Cortlandt St. Boston Office, 70 Pearl St.



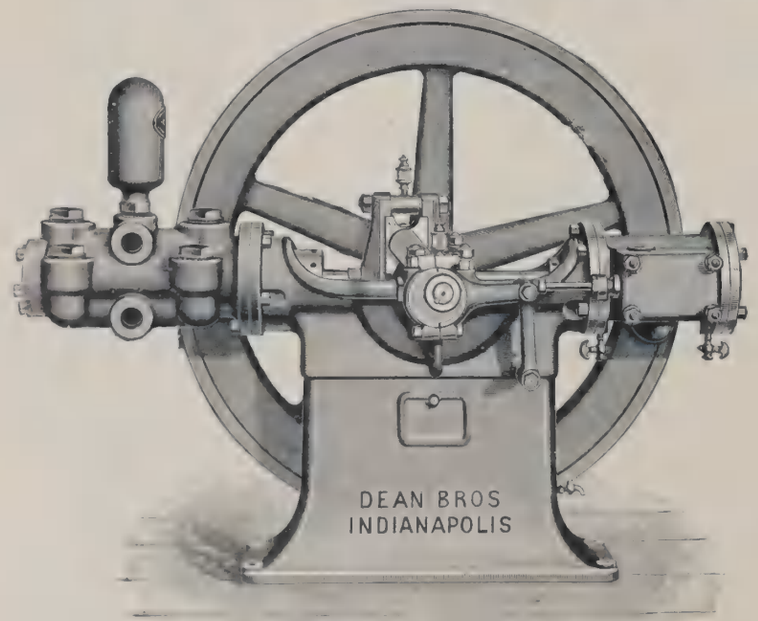
DUPLEX WATER SUPPLY PUMP.

DEAN BROS.

Steam Pump Works

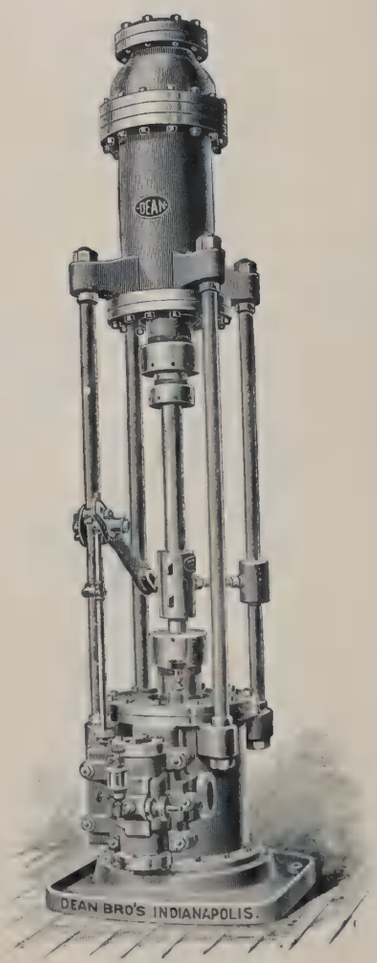
INDIANAPOLIS, IND.

BOILER FEEDERS, BRINE PUMPS,
DEEP WELL PUMPS, SINGLE AND DUPLEX PUMPS.



HORIZONTAL AMMONIA PUMP.

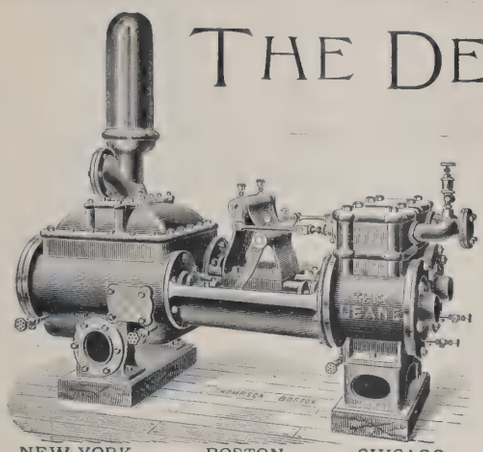
SEND FOR CATALOGUE



VERTICAL AMMONIA PUMP

THE DEANE STEAM PUMP CO.

HOLYOKE, MASS.



STEAM PUMPS

FOR EVERY SERVICE.

AMMONIA PUMPS,
BRINE PUMPS,
TANK PUMPS, ETC.

For Ice Manufacturing Machinery

For full information and Illustrated Catalogue, write . . . . . .

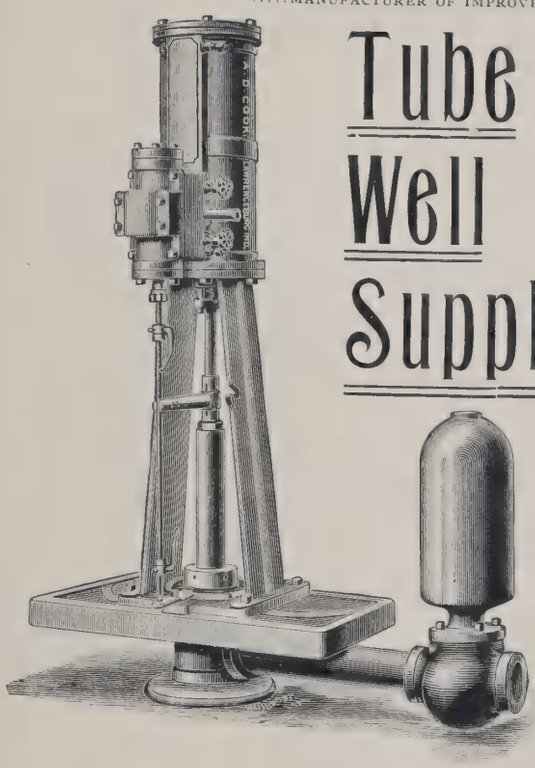
NEW YORK BOSTON CHICAGO.
PHILADELPHIA. ST. LOUIS. DENVER.

DEANE STEAM PUMP CO., Holyoke, Mass.

A. D. COOK

.....MANUFACTURER OF IMPROVED.....

Tube Well Supplies



Cook's Patent Tube Well Strainers

.....AND.....

STEAM PUMPS ...A... SPECIALTY

LAWRENCEBURG, IND.

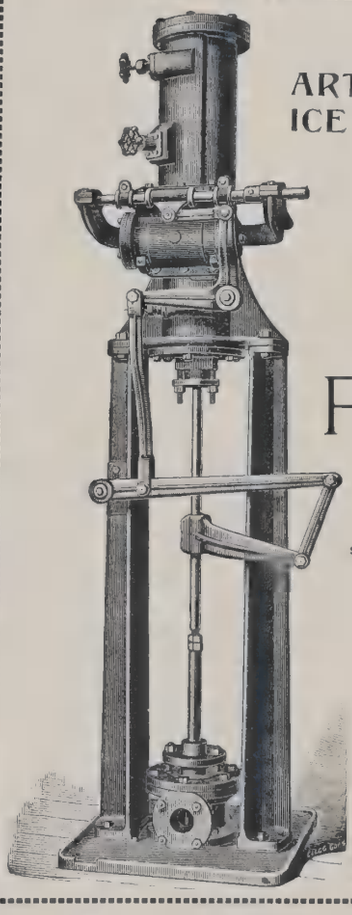
EPPING Pump

. . . DEEP-WELL

.....FOR.....

ARTIFICIAL ICE COMPANIES

BREWERIES
COLD STORAGE
WAREHOUSES



PUMPS

For all Purposes.

SEND FOR CATALOGUE TO

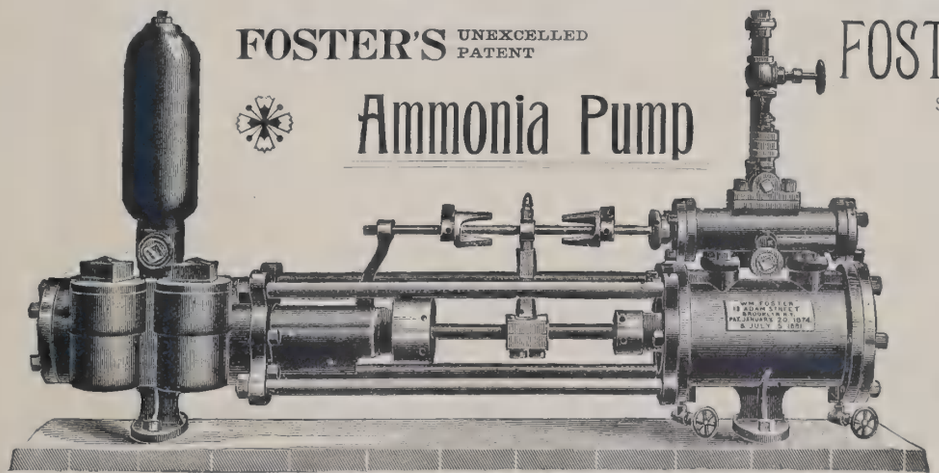
EPPING, CARPENTER & CO. LIMITED,

2410-2420 Penn Ave.,

PITTSBURGH, PA.

FOSTER'S UNEXCELLED PATENT

Ammonia Pump



ing-box is carried back into the suction again. It has extra hard steel Piston Rod, which is made in two ammonia part of piston rod is worn out, and without necessitating the removal of the steam portion of rod.

FOSTER PUMP WORKS

Successors to WILLIAM FOSTER

MANUFACTURERS OF

PATENT IMPROVED

STEAM PUMPS

FOSTER'S EXCELSIOR ROTARY PUMPS,

Beer and Mash, Boiler Feed, Tank, Air, Deep Well and Artesian Well Pumps.

36 AND 38 BRIDGE ST. BROOKLYN, N.Y.

The advantages of this Pump are, its extra long double stuffing-box, which is so arranged that any leakage from first stuffing-box is carried back into the suction again. It has extra hard steel Piston Rod, which is made in two sections, so as to be easily replaced when

HERF & FRERICHS CHEMICAL CO.

ST. LOUIS, MO.

MANUFACTURERS OF

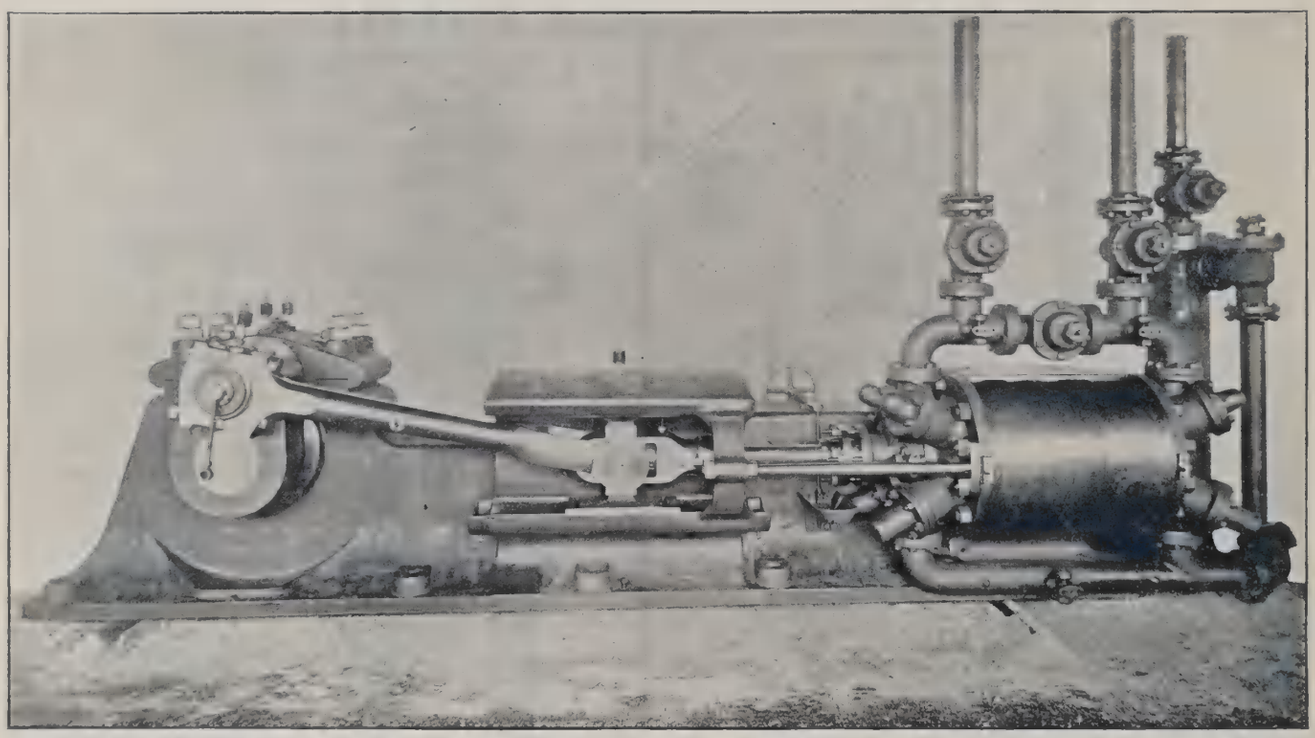
Liquid Anhydrous Ammonia

ABSOLUTELY DRY, PURE AND UNIFORM ALL THE YEAR ROUND . . . . .

26° Ammonia

SPECIALLY PURIFIED FOR ABSORPTION . MACHINES . . . .

All our Ammonia is made from Sulphate Ammonia only. Large capacity, best qualities and quick shipments.



No. 8 LINDE COMPRESSOR

100 TONS CAPACITY.

MANUFACTURED BY

THE FRED. W. WOLF CO.

560 North Halsted Street, CHICAGO, ILL., U. S. A.

FOR ICE FACTORIES, COLD STORAGE HOUSES, BREWERIES AND PACKING HOUSES . . . . .

CORRESPONDENCE SOLICITED. . .

OVER 1300 MACHINES IN ACTUAL OPERATION.

ICE AND REFRIGERATION

ILLUSTRATED

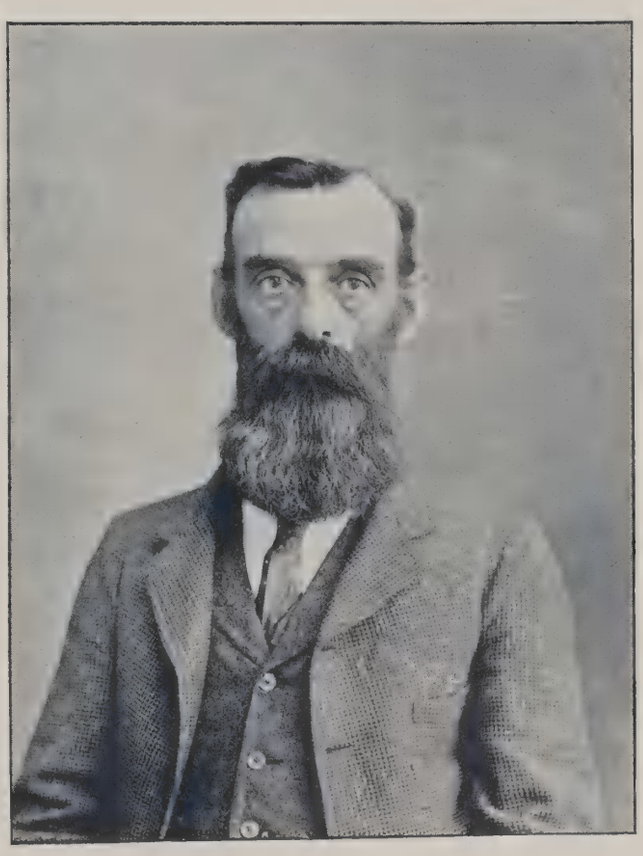
A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. I. NO. 3. CHICAGO : NEW YORK : SEPTEMBER : 1891. $2.00 PER ANNUM.

THE SOUTHWEST ICE MANUFACTURERS ASSOCIATION.

CAUSES LEADING TO ITS ORGANIZATION—THE AGREEMENTS ENTERED INTO AND THE RESULTS ATTAINED—BIOGRAPHICAL SKETCHES OF OFFICERS.

The Southwest Ice Manufacturers Association was organized as a measure of self-defense on the part of its members. The great, and, perhaps, in some cases, injudicious, increase in that section of ice making plants, made it certain that unless some concerted action could be taken, a general scramble for territory and sales would demoralize prices on the product throughout the district, and a "give and take" free fight would be inaugurated, in which all parties would suffer.



W. O. CALDWELL, FORT SMITH, ARK.

A call, signed by the Crystal Ice Co. and the Frigid Ice Co., of Joplin, Mo., was therefore issued April 13, 1891, for a meeting to be held at Joplin, April 23, 1891. At this meeting, owing to the short notice given, only six plants were represented: The Border City Ice and Coal Co., by W. O. Caldwell, Fort Smith, Ark., Carthage Ice and Cold Storage Co., by C. M. Gay, Carthage, Mo.; Frigid Ice Manufacturing Co., by W. A. Ward, Crystal Ice Co., by N. Zentner, Joplin, Mo.; Race Bros., by A. S. Race, Fredonia, Kan., and Parsons Ice and Cold Storage Co., by F. A. Lewis, Parsons, Kan. At this meeting an organization was effected, Mr. W. O. Caldwell being elected president, and Mr. C. M. Gay, secretary. The business of the district was fully discussed, and letters of approval were read from Guthrie, Ok., Arkansas City, Kan., and Nevada, Mo. After careful deliberation the following resolutions were adopted and signed by all the firms present:

"*Resolved*, That each of the concerns represented in this convention agree and covenant to abstain from selling ice in the towns other than their own occupied by plants accepting and ratifying the proceedings of this convention, and each factory shall be permitted to make and maintain prices in their home town market, at their own individual discretion, and any plant which shall without the permission of the resident manufacturers enter the home town market of another member of this association shall be held as violating the spirit of this agreement, and to be placed without the pale of membership and excluded from exchange of courtesies by all members of said association.

"*Resolved*, That it shall be incumbent upon each member when receiving an order for ice which they cannot fill, that the order shall be forwarded by wire to the associate factory nearest the point where the order comes from (or notice of such order) which factory if unable to fill order shall pass it on by wire to the next nearest factory, and the factory receiving the message shall in each case pay telegraph charges on messages so received, and acknowledge by first mail receipt of message and what action was taken."

It was ordered that the resolutions be in force for the season of 1891, and a copy sent to all manufacturers in the district, any and all of whom could be enrolled in full membership upon application to the chairman or secretary. The chairman and secretary were also authorized to act as grievance committee to decide upon questions of violations of agreement, whose decision shall be final. The name, the "Southwest Ice Manufacturers Association," was adopted, when the association adjourned for one year, pending a call of the chairman.

Since April 23, the membership of the association has been doubled, and now embraces twelve plants, with a capacity of over 200 tons daily, and the indications are that the membership will be quadrupled before the end of the year.

As to the results attained by this association, Secretary Gay writes: "I am happy to say that the spirit of association and agreement has not been violated in any single instance, so far as I am aware. A distinct kindly and fraternal feeling seems to pervade the entire membership, in broad contrast to the intolerance often manifested between plants not bound by a common tie of courtesy and friendship. I firmly believe that the fellowship and good will, and the benefits accruing to the members of this association, in its first season's existence, will tend to bring about closer alliance in the future, and to extend the present work on broader and more advantageous lines."

SKETCHES OF OFFICERS—W. O. CALDWELL, PRESIDENT.

Mr. W. O. Caldwell, president of the Southwest Association, is a native of Arkansas, having been born in Little Rock. His connection with the ice trade of the Southwest dates from 1885. In 1884 Goodbar & Cherry erected a 5-ton plant at Fort Smith, to which firm Mr. Caldwell was admitted as a member in June, 1885, assuming control of its management, the name of the firm changing to Goodbar, Cherry & Co. In 1886 the owners threw it into a stock company under the name of the Border City Ice and Coal Co., electing L. W. Cherry president and W. O. Caldwell secretary and treasurer, and increased the capacity of the plant by the addition of another 5-ton machine. Mr. Caldwell remained its secretary and treasurer until late in October, 1887, when he resigned, and, in company with some friends erected and equipped a 5-ton machine at Sulphur Springs, Tex., under the name of the Sulphur Springs Ice and Industrial Co., of which company he was elected secretary and treasurer. He remained in Texas during 1888. His business interests, however, in Ft. Smith, on account of the death of his partner, Mr. Weems, of the drug firm of Caldwell & Weems, recalled him to Arkansas, and resigning his position in Texas he was forced to return to the "Border City" and give his personal attention to his mercantile business (drugs), which he did until February, 1891, when he again bought stock in the Border City Ice and Coal Co., and for the second time was elected its secretary and treasurer, its capacity having meantime been increased from a daily output of ten tons, in 1887, to twenty-three tons in 1888. Since then the business has steadily increased, so that the company has just contracted for an additional 50-ton machine which they will have in and ready for the season of 1892, together with a large cold storage room (working under direct expansion). In fact, they intend to take care of every interest where ice and refrigeration cut any figure.

At the next meeting of the directory of the Sulphur Springs Ice and Industrial Co. in Texas, after Mr. Caldwell left there, he was elected president, which position he has held ever since; so it will be seen that his time is pretty well occupied between two ice factories and the drug store, all of which are managed with consummate skill and enviable financial success.



C. M. GAY, CARTHAGE, MO.

MR. C. M. GAY, SECRETARY.

Mr. Gay is a native of Pennsylvania, having been born in Erie county, in 1862. His mechanical education began at the age of sixteen, and after serving an apprenticeship in his father's mills, he was engaged as engineer in flouring mills. Later, however, being an expert stenographer, that vocation was followed; and his knowledge of machinery naturally brought him into work connected with lines of machinery, as stenographer and correspondent. In 1884 he became connected with the Consolidated Ice Machine Co., of Chicago, where full opportunity was afforded him for a thorough investigation of advanced shop practice and construction, as well as the general condition and progress of the art of ice making and refrigeration. In the latter part of 1889 he resigned his position with the Consolidated people, and soon after organized the Carthage Ice and Cold Storage Co., of Carthage, Mo., with a capital stock of $50,000, and erected a 20-ton Consolidated ice making plant and cold storage house of nine rooms. Under his direction some novel and advanced ideas were incorporated in the construction of this plant, and the company operating it is regarded as one of the most prosperous in the city. Mr. Gay is one of the chief promoters of the Southwest Ice Manufacturers Association, and believes firmly that in harmony and concerted action among manufacturers lies the greatest element of strength and success.

PURE chloroform, something heretofore unattainable, will now be made by M. Pictet, a chemist of Geneva. The majority of deaths from chloroform are said to be traceable to impurities. One feature of M. Pictet's process is the reduction of the chloroform to the coldness of 130 deg. below zero.



RAILWAY REFRIGERATION.

A SHORT SKETCH OF THE EVOLUTION OF THE REFRIGERATOR CAR—THE DRESSED BEEF CAR IN PRACTICE—HOW IT IS ICED, CLEANED, ETC.

The part taken by refrigeration, applied to railway and steamship transportation, is one of the most interesting cotemporary studies in connection with the problem of distribution of the world's products. It has opened up new lines of commerce between nations, and developed the greater resources of sections of our own country, without which their characteristic products would be practically worthless—as the fruit regions of the tropics and of our own South and Pacific coast, and the grazing lands of the antipodes—and made possible the marketing of many valuable food products of every section that otherwise would be valueless outside their immediate place of production. It has also rendered possible the establishment of great industries for food production and distribution, which have added enormously to the wealth of both the city and country, and, in connection with cold storage, has given the great mass of the people a greater variety of wholesome foods and for a longer period of the year than a generation ago would have been dreamed of as possible or probable; for the meats, fish and vegetables, that in older times had to be consumed soon after they were produced, are now preserved for long periods and transported long distances to consumers, who, but for these modern appliances, could never taste many of the luxuries of our every-day life, not to mention many foods that are to-day deemed actual necessities.

The American refrigerator car is hardly twenty-five years old, the first American patent for such a railway car having been issued to J. B. Sutherland, of Detroit, November 26, 1867. His car was so constructed that the air admitted at the top of the car passed down through the ice chamber and was discharged into the cooling room near the bottom to reduce its temperature. His claim covered a car with double walls, roof and bottom, with ice chests at each extremity, closed by hanging flaps, and having spaces so arranged as to produce a constant circulation of air in the car. From this time on, patents for refrigerator cars came thick and fast. In March, 1868, Geo. K. Wood, of Morristown, N. J., brought out a car with a plurality of metallic chambers for the respective reception of way and through freight, with an ice chamber above. The car of A. L. McCrea, of Chicago (March, 1869), had interior movable sections; and that of Thos. L. Rankin, of Granville, Ill. (December, 1870), was built with ice boxes raised above the roof of the car on either side of the brakeman's walk.

Some of our inventors seem to have endeavored to produce a car with as many mechanical complications as possible, forgetting that all machinery, especially such as must be operated and handled by inexperienced labor, should be as simple in mechanism as is consistent with the duties it is expected to perform. C. L. Hoag and E. Ely, of Lockport, N.Y., doubtless found this an obstacle to extensive use of their car (October, 1871). It was ingeniously designed, having the ice box at one end of the car, with a complicated system of air passages and valves for the regulation of the air currents to the preserving chamber. It had also an observation chamber. A. S. Lyman, New York city (December, 1871), created a current of air under the roof over the ice into the cooling chamber by means of a wind wheel on the roof of the car. Mr. S. G. Bilyeu, Charleston, S. C. (May, 1874), quite excelled in ingenuity by a car having a revolving ice cylinder within an automatic air receiver, with an air passage and ventilator to cool the air admitted at the top, and force it into the cooling chamber at the bottom, and crowd the hot air therein out at the top. The ice cylinder was revolved by a wind wheel moved by the motion of the car. R. W. Sanborn, of Rochester, N. Y. (June, 1874), however, made an entirely new departure, by producing a car which was constructed to be automatically self-cooling, without the use of ice. In the top of the car he provided perforated trays of wood to contain water or ice, with perforated covers, having wooden or other conductors, which hung down into the trays to conduct the water up through the cover so that it was quickly evaporated, the car being thus cooled by evaporation. The trays were made with an air space all around, the tight-fitting cover of the water pans having holes filled with wood, sponge or other porous materials to absorb the water and hasten the evaporation to reduce the temperature of the cooling chamber.

Approaching simpler methods, Mr. Richard J. Tunstall, St. Louis (September, 1872), cooled his car with a V-shaped ice receptacle running through the car from end to end, to be filled from the top, and having vertical drips at either end. Richard Armiger, Baltimore (June, 1875), placed

his ice in a metal receptacle at the top and in the center of the car, both ice chest and provision chamber being air tight. The metal bottom of the ice box formed the roof of the provision chamber, with a false roof of metal to catch the condensation of vapors within the car, and carry it off in troughs under the ceiling. J. H. Camfield, St. Louis (August, 1875), built his car in three sections, with ice chambers above and vertical water pipes through the car. Under the ice was a zig-zag pan through which the air circulated, acting as a condenser for vapors and conductor of the drip from that source. Openings from the ice box admitted the cold air to the cooling chamber, and valves admitted the outer air to the ice.

These earlier patents were, as may be inferred, more interesting than practicable, however. They were too complicated in construction to meet with popular approval, and were overloaded with unnecessary details, rendering them unsatisfactory in practical operation, though they may have served their purpose theoretically. The requirements of practice demand the utmost simplicity of construction, as well as ease of operation in transit; and until that was obtained the refrigerator car in practice was but an attractive theory.

While Ice and Refrigeration may in the future continue the study of the evolution of the refrigerator car, as shown in the patent office, which is an interesting study in itself, at this time, however, it is more to the point to examine a car of this class in actual operation; and for this purpose a simple description of the Hamilton car, in use by Armour & Co., the great packing house, of Chicago, may not be uninteresting.

The car itself is a model of simplicity, both in its theory of construction and in its method of producing the requisite degree of cold within the car, as well as the means of holding that degree of cold until the car has arrived at its destination, and its contents been removed.

Insulation is obtained by a construction combining wood, air space, paper and hair felt, the roof, walls and bottom of the car being seven inches in thickness, with a dead air space and three one-inch layers of hair felt, the joints of the doors being padded to make them air tight when closed. The ice receptacles are simply strong galvanized iron cans, four of which fill each end of the car, making eight ice cans per car. These extend from the roof to within six or eight inches of the floor, and under them is a pan to catch the drip, the overflow escaping through an air tight trap. The ice cans are jacketed with galvanized iron, open top and bottom. No air enters the car, and there is no provision for mechanical circulation of air within the cooling chamber. The ice is loaded through the roof, each car carrying about 6,500 pounds of ice.

The icing station at Chicago, where the cars are loaded, is at the stock yards, where the ice is received in the firm's cars from their own houses in Wisconsin. From the car the ice is run up an incline to a crusher, and there broken up into small pieces, ranging in size from chips to chunks the size of a man's head, and is discharged into great iron buckets holding about 500 pounds each, the ice being then mixed with a species of fine rock salt. It is then pushed on overhanging carriers to the car being iced. Each can is filled with this crushed ice and salt, which is tamped in to the can's utmost capacity, when the covers are put on and the roof holes closed. The car then stands under cover to cool, and within about eighteen to twenty hours the cooling chamber has been reduced from the normal temperature of the atmosphere without to about 33 deg. The car is then re-iced, about 1,000 pounds in general being required to refill the cars, and is then moved to the cooling room of the packing house, to be loaded with dressed meat for the East or South.

The car, then, has the same temperature practically as that of the cooling room of the packing house, and so rapidly is it loaded that there is no appreciable rise in the temperature during loading; nor is there any heat in its contents of dressed carcasses to raise the temperature of the car after loading. The problem of the case, therefore, is to maintain the original temperature of the car during transit. Theoretically the insulation of the car is perfect; in practice, however, it is simply good, so that in transit re-icing is a frequent necessity. Thus a train of Armour cars in transit from Chicago to New York or Boston *via* the Lake Shore and New York Central roads, are iced daily on the route—at Chicago before loading; at Collingwood, end of first day out; at Buffalo, end of second day; at Albany, third day, at each of which re-icings each car will take on from 900 to 1,000 pounds of ice. By this system of re-icing, the temperature of the car is held between 33 deg. and 36 deg., seldom rising above the latter figure at any time in transit during the severest weather, trains, of course, being run as "time" freights. This car has been so successful that Armour & Co. are now running from 2,500 to 2,600 on their routes to all parts of the country, each route being, of course, provided with icing stations at regular intervals, the ice being supplied from their own storehouses or by the railway companies, over whose lines the cars travel; and it has been found in practice that with proper care in icing neither distance nor climate is a bar to the delivery of dressed meat from Chicago to any point within the United States.

The enormous growth of the western dressed meat trade in the east in the hands of such men as Armour, Morris and Swift, the "Big Three," as they have come to be called during the past month, which has been built up almost entirely within the past ten years only, by means of the refrigerating machine and the refrigerator car, has, of course, created more or less feeling against a business that will doubtless eventually practically control the abattoirs of the east, the slaughtering of cattle being done in the west, nearer the ranges from which cattle are received in prime condition. Without now going into this subject further, one phase of the prejudice sought to be created against this trade in the east merits attention in this connection. It is the familiar statement that "the stock yards and packing houses of Chicago are so filthy that the agent of the German government who is kept there to report upon them, refuses to recommend meat packed there for German consumption. It is also reported that it is impossible to place them in a clean and wholesome condition, and keep them so. . . . In other words, Americans will still continue to consume filth and disease from which the German government protects its subjects."

This quotation is largely of that species of buncombe which certain newspapers delight to indulge in at frequent intervals. Of course, a great stock yards like that at Chicago has not by any means the flavor of the attar of roses that perfumes my lady's chamber, but it is

doubtful if any abattoir in the land can be found in cleaner condition than the great packing houses, where cleanliness is exacted of employes not simply for the sake of cleanliness only, but because there is money in the collection, storage and preservation of every particle of the refuse that makes filth about a packing house—the sweepings and the refuse of the floors being removed for manufacture into by-products, the sale of which enables the packers, as the common packing house phrase is, to "get more out of a critter than there is in him." When the refrigerator cars of these firms return from their journey home again they are turned over to the cleaners. Every metal-lined small-meat box is removed from the car, every hook for carcasses taken down and sent to a bath of boiling water and soap, and thoroughly scoured, rinsed and dried. The walls, ceiling and floor of the car in like manner are scraped, scalded and scoured with boiling water and soap, rinsed and aired until dry before icing for reloading with dressed meat, each quarter or carcass of which bears the tag of the government inspector, and also the number tag of the packing house itself. It will thus be seen that filth and disease are not transported in refrigerator cars. The packer is clean because there is money in the by-products obtained by thorough cleanliness; the government tag is guarantee of the purity of the meat, while the packer's number tag on each piece of meat shipped (which is duly registered at the home office) is the identification of that quarter or carcass from the hoof to the consumer.

A STEAMSHIP REFRIGERATOR.

The latest addition to the English South African line of steamships is the new steamer *Scot*, a steel vessel 500 feet long over all, fifty-four feet six inches beam, and displacement of 10,000 tons. She is a model of modern commercial steamship engineering in every respect.

In view of the hot climates in which the *Scot* will trade, special regard has been given to her ventilation, and in order to insure a constant supply of fresh meat, vegetables and fruits to the passengers, and a constant supply of ice, a cold air machine is fitted on the platform in the engine room by Messrs. J. & E. Hall, Limited. It consists of a horizontal steam engine fitted with surface condenser, vertical air, circulating and feed pumps, and provided with means for varying the steam cut-off while running. From a crank in the center of the engine crank shaft an air compression pump is driven which delivers its air at about sixty-pound pressure into the tubes of a cooler similar in construction to a surface condenser, and having sea water circulating round the tubes. From this cooler the air is led through an air desiccator, and thence into an expansion cylinder driving on to a crank at the opposite end of the crank shaft to the steam cylinder. The cooler and condenser form a foundation for a double Corliss engine frame, carrying the three cylinders at one end, and the crank shaft, fly wheel, etc., at the other. The pumps are driven from the compression cylinder cross-head through a weigh shaft, which also drives some of the valves. The compression cylinder is fitted with slide valves, instead of the ordinary beat valves, and the expansion cylinder has separate valves for inlet and exhaust, the exhaust valves being balanced piston valves. The air is delivered into the chambers through wooden trunks, leaving the machine at about 80 deg. below zero F., and is drawn back through similar trunks to the suction of the compression cylinder. The chambers are fitted up so that the cold air is utilized successively for making ice; freezing and keeping frozen meat, fish and poultry; cooling water for drinking; cooling wines, aerated waters, etc.; and, finally, for maintaining a temperature of about 40 deg. in the chamber where the vegetables, fruit, etc., are kept. Electric mercurial thermostats have been fitted by Messrs. Binko & Co., London, so that the temperature in the various chambers may be indicated constantly to the operator at the refrigerating machine, who can thereby regulate it. The special feature of this new appliance is that the thermometer has a steel bulb inclosed in a frame provided with a set screw. By means of this screw the form of the bulb can be altered so as to adjust the instrument in order to bring the head of the mercurial column to the platinum contact wire exactly at the desired temperature. By this arrangement any change that may take place in the thermometer can be compensated for. One wire of the electric circuit is connected to the bulb, and the other to the platinum contact, and a bell is introduced into the circuit to call attention when the temperature rises too high.

THOS. J. LEMON, of New York city, has patented a family ice machine, consisting of a tank having a removable cover, suitable molds inclosed by a skeleton cylinder having spiral walls being mounted in the tank, there being a gear mechanism connected with a crank handle for operating the cylinder. The molds are filled with water to be frozen, and the tank is filled with chemicals forming a freezing mixture, when, by turning the crank handle, the cylinder is revolved, agitating the chemicals and causing them to act rapidly upon the water in the molds.

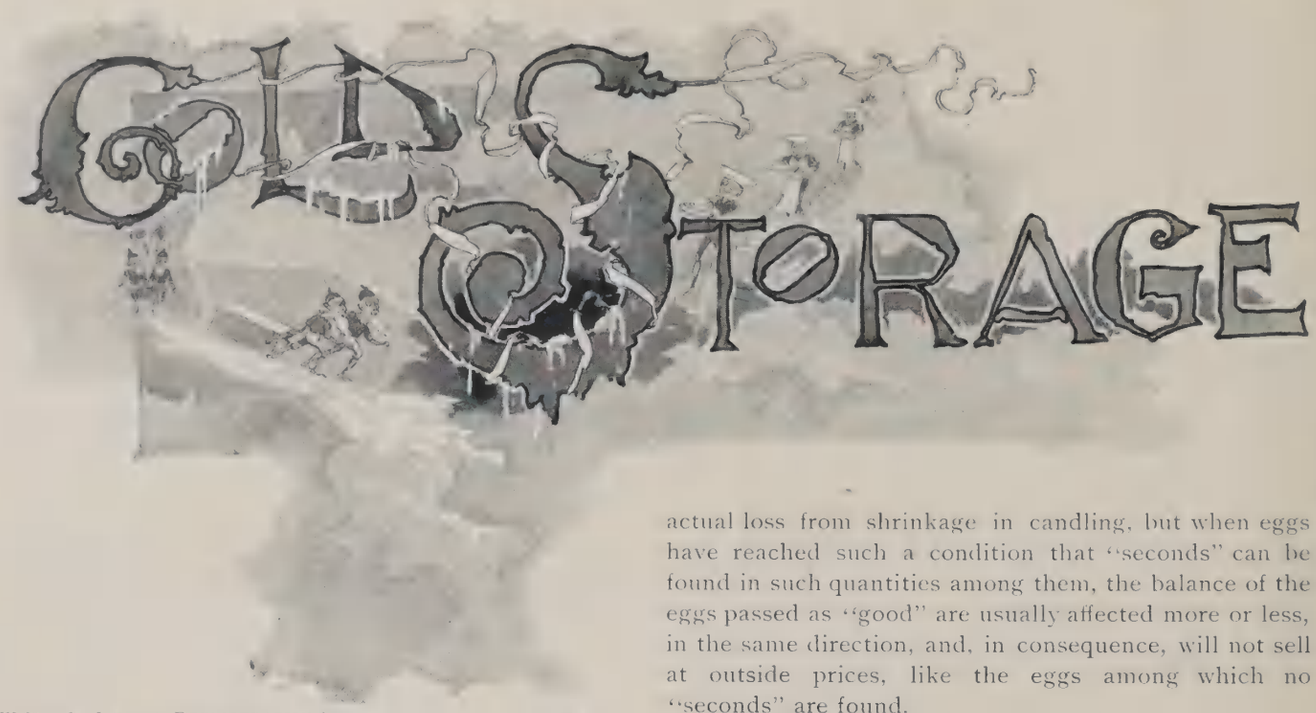
EXPLORERS of Banning, Cal., have found a mighty mass of moving ice in a deep canyon on Grayback mountain. The formation is about twenty-five feet thick and sixty feet wide. Immense rocks have been pushed from their beds by the moving of the great ice mass, and lie upon top of it. The sun does not reach the ice for more than one hour a day.

NEWS NOTES.

——One hundred refrigerator cars are to be added to the Chicago & West Michigan railway equipment for the proper handling of the lake shore fruit crop.

——The handling of fruits requires specially built cars, carrying large quantities of ice and moving as rapidly as fast express trains, especially fruit trains across the deserts of Arizona en route from California to Chicago. During the spring an additional line making a specialty of this class of freight, known as the Pacific Fast Freight Line, was put on the A. & P. and Santa Fe routes, starting in business with 150 cars. The California Fruit Transportation Co., of Chicago, is also making preparations to handle this class of freight in the near future.

——In the August issue, ICE AND REFRIGERATION made note of the failure of Mr. E. P. Bender and others at Three Rivers, Quebec, Canada, to obtain from the Canadian government a permit to import American cattle in bond to slaughter at Three Rivers for export. On August 5, however, the imperial government reversed its former ruling and consented to the admission of American cattle into Canada for slaughtering purposes, provided that proper regulations for the safety of Canadian cattle from any possibility of infection are enforced. This decision will lead to the establishment of a mammoth abattoir at Three Rivers, on the St. Lawrence below Quebec, by Mr. E. P. Bender, a French Canadian, who is associated with New York and Chicago capitalists. It is proposed to slaughter about 1,000 cattle a day and ship the meat in refrigerators to Europe. Mr. Bender says he can compete on favorable terms with the Chicago packers, as labor is cheaper in Canada, and he has a more direct route to the English market.



[*Written for* ICE AND REFRIGERATION.]

HOLDING EGGS IN COLD STORAGE.

HOW IT CAN BE SUCCESSFULLY DONE—THE PROPER TEMPERATURE OF THE AIR IN STORAGE ROOMS—COLD STORAGE SYSTEMS.

BY D. B. BEEMER.

To be successful, two conditions are indispensable—dry air and good eggs.

As to temperature.—If it be conceded that it is the cold air in the rooms that holds the eggs in good condition, it would seem naturally to follow that the colder the air is without actually *freezing* the eggs, the better it would be for them. Yet this is not entirely true. Eggs may be held in a temperature that will freeze water without being themselves frozen; but this low temperature is apt to have the effect of chilling them. The effect upon them of this is similar to that produced by giving them an instantaneous bath in hot water; it disorganizes to some extent that portion of the egg contiguous to the shell.

Many years ago I began by holding eggs in a temperature of 40 deg. F., and yearly reduced this, more or less rapidly, in different rooms, till I reached the freezing point. Results showed me that a temperature of 34 deg. to 35 deg. F. turns out by far the best eggs. I am aware that this idea is combated by cold storage people whose systems are not capable of attaining this degree of cold; and none of the systems which store ice in bulk overhead, and but few of the side tank systems, can get below 37 deg. when rooms are empty, while with rooms full of eggs throwing off caloric, they seldom stand below 40 deg. F. It is, with these men, only a case of sour grapes—they *would* hold colder if they *could*.

April and May eggs, properly candled before storing, and held in a dry room at 35 deg. F., should come out *all good* in November following; while the average cold storage houses (using natural ice) with temperature of 38 deg. to 40 deg., shrink eggs in the fall from two to three dozen or more per case, partly owing to high temperature and partly to *dampness*. This makes a great difference in profits to holders. It is not only the matter of actual loss from shrinkage in candling, but when eggs have reached such a condition that "seconds" can be found in such quantities among them, the balance of the eggs passed as "good" are usually affected more or less, in the same direction, and, in consequence, will not sell at outside prices, like the eggs among which no "seconds" are found.

But unless the air in the cold rooms is dry, no degree of cold will hold eggs successfully beyond a limited time, depending upon the *degree* of dryness in the rooms. This varies with different systems; and the dampness in cold storage rooms is therefore to be considered, in a *comparative sense*. My observation, extending through many years, involving the examination of the output of many western plants and systems, whose stock is yearly put upon the market for sale through commission houses—the noting of the continual complaints of retailers and consumers using this stock, and continual references in the market reports of the great trade centers, every fall and winter, to the great quantities of "off" stock received on consignment from cold storage, and closed out often, as a last resort, to the manufacturers of patent leather and of so-called "fresh egg albumen," at the nominal price of $1 per case—lead me to the conclusion that *none* of the present systems of cold storage using natural ice have yet attained in their cold storage rooms that degree of dryness of air that will enable them to carry eggs successfully for a longer period of time than *from four to six months*.

The various systems of cold storage, involving the storing of ice in bulk over the rooms to be cooled, depend upon drying the air by *circulating* it as follows: Two air shafts, or pipes, are constructed to connect the cold rooms with the space above the mass of melting ice. These are usually placed upon opposite sides of the rooms; but the principle is modified to other forms in different systems.

The *theory* is, that the cold air above, seeking a lower level, as is its nature, will fall down through *one* of these shafts into the room below, forcing a like quantity of the warmer air next the ceiling up through the *other* pipe, or shaft, to the space above the ice, thus forming a circuit out of the cold rooms up over the ice above and back into the cold rooms again; and that the air in its passage over the ice *will be dried*. This reasoning, however, is, in great part, *a fallacy*, because the body of ice over which the air passes, and which is expected to absorb the moisture from the air by condensation, is itself in a melting, dripping condition, in most cases, and,

therefore, in shape to *impart* dampness to the air rather than *absorb* from it. When, from any peculiar circumstances the mass of ice is at freezing point and therefore *dry*, it will, of course, dry the air passing over it by condensing the moisture out of it—*not otherwise*. The side tank systems are still worse off, since their *side* drafts are weak compared with the *vertical* drafts of the overhead systems, while the ice in the tanks is melting more rapidly and throws off more dampness relatively.

Now, *as to results*.—To the ordinary observer these rooms may *seem* dry. The owner will take you into them and triumphantly strike a match upon the walls of the room, or upon the cases in it, as proof of dryness; but this test cuts no figure in the case of eggs. *The paper "fillers" in the cases* are the barometers to depend upon.

The rooms stand open before using and are naturally thoroughly dry—walls and all—when stock begins to go in. Then the cold, damp air is loosed from above, or the side tanks charged with dripping ice, and the strife begins between cold and heat. Most people have the bad habit of opening the side doors of the rooms to load in stock. Stock, on the contrary, should only be introduced into the rooms through hatchways in the floor above. Cold air, being heavy, will not rise out through the hatchway, and, therefore, the air in the room will only be changed or affected by the warm air thrown off by the goods stored. On the contrary, when a *side* door is opened, the cold air at once rushes out through the lower half of the open door, while the warm outside air rushes into the room through the upper half of the open door to replace, at the ceiling, the cold air running out at the floor. When the door is at last shut, the temperature of the room has risen from 5 to 10 deg., and this imprisoned warm air is condensed upon the cold walls, forming moisture like that on a pitcher of cold water on a hot day—particularly upon the ceiling. This moisture has got to be taken up in some way. A part of it will be carried off by the draft pipes thus early in the season, when they do fair work, while some will be absorbed by the paper "fillers" in the cases. And this absorption of damp air by the fillers *goes constantly on from this time forward*. Any system of cold storage having the requisite degree of cold will carry eggs successfully for a limited length of time, depending upon the degree of dampness in the room. The damage to eggs in cold storage from dampness *does not develop suddenly*—it is of a *cumulative nature*!

When the paper fillers have at last absorbed moisture to that degree that they have become thoroughly damp—not to say wet—the odors from the chemicals used originally to rot the straw from which the paper was made become liberated, and the eggs absorb them through the pores of the shell, and in effect become *limed* eggs, since *lime* enters more largely into the manufacture of the straw into paper than any other article, and imparts its odor to it more largely in consequence. This stage is reached in the average cold storage rooms in from four to six months—then trouble develops rapidly! The damp, foul gases in the cases, liberated from the damp "fillers," brings on mold upon the fillers and upon the eggs. In the earlier stages this mold on the eggs is light and frost-like, in detached crystals, hardly noticeable in daylight. If marketed then they will be found but little hurt—the slight mold disappearing in the handling. A little later, however, the mold thickens upon the shell and the eggs look as though they had been packed in meal or "shorts." This sort of mold drives quickly through the pores of the shells, and the eggs become *musty*, and in great part unsalable.

Cold storage men have at last learned through bitter experience that the profits from holding eggs depend largely upon *early marketing*; and cold storage eggs are now mostly sent to market in October and November to avoid the loss consequent upon later holding, though probably most of these shippers, although recognizing the fact of loss resulting from longer holding, are yet unable to assign the cause for the seeming sudden change in condition of eggs at the period referred to. Now, were the rooms *really dry*, the "fillers" in the cases would remain dry as when put in, and in consequence there would be no damp in the cases to mold the eggs, and the loss off at the end of the season would be confined to "spotted" eggs, and depend upon the temperature of the rooms.

The best eggs to put away are April and May eggs. These, because of the cool weather prevailing then, are usually of a uniform grade and quality, appearing to be as clear as a sunbeam when held before a candle in a dark room. The "whites" of the eggs are then thick and gelatinous in their nature, and from their *density* are able to hold the yolks in suspension in their natural position in the center of the egg for a lengthened period of time. Production is also heavy at that season of the year, necessitating regular and constant shipments to market to keep stocks from accumulating. As warmer weather comes on production falls off—farmers become busy seeding, and careless about marketing their eggs. They accumulate but slowly in shippers' hands in consequence, and become fly-specked and discolored. The yolks begin to cast shadows, more or less dense, when the eggs are held before a candle in a dark room, forming the grade known among dealers as "seconds." The "whites," evaporating in part through the pores of the shell, become thin and watery, allowing the yolks to settle through them to the bottom of the shell, to which they adhere, making "spotted," worthless eggs. Then, too, when a man offers eggs for sale in winter time, which are covered with fly specks, and claims that they are "fresh," the eggs "give him away."

As to the matter of turning cases while in cold storage, as advocated and practiced by some: I never have any trouble with yolks settling through the dense whites of the spring eggs when held in a temperature of 34 to 35 deg. F. With the *summer* eggs described above, however, it *becomes a necessity*. If cold storage eggs are marketed when the outdoor temperature is higher than that inside the room, great care must be taken in handling to prevent loss. Eggs under such circumstances are affected much like *fruit*. One may carry oranges and lemons and other fruit in cold storage in fine condition for months; but if he takes it out and ships it in July weather, the sudden change in temperature will often rot it down in twenty-four hours, particularly if it is not spread out upon drying tables and allowed to "sweat" and dry off again before being repacked in dry papers. The weather when eggs begin to move from cold storage is, of course, relatively colder and the effect not so marked; yet unless the outside temperature is below 40 deg., the eggs intended for a local market should be allowed to stand in the case a day or so, and permitted to "sweat,"

or acquire surrounding temperature, and then be repacked *in dry fillers*. If about to ship cold eggs any distance, they should be *quickly* transferred in original package to a refrigerator car properly iced; or if "candled" first, it should be done in the cold room to prevent "sweating," and dry fillers used if the others are damp. If eggs are shipped in a refrigerator car, it should be re-iced at intervals in transit, and if the consignee is not able to close out at once upon arrival, he should transfer the stock quickly from the car to a refrigerator room.

A great many *good* cold storage eggs have been spoiled carelessly by consignee by stacking them up in bulk in his warm salesroom and allowing them to stand, while holding for a price or peddling them out slowly, till they sweat—getting fillers damp, and eggs "musty."

The president's proclamation announcing reciprocity with Cuba, San Domingo and Porto Rico, under the tariff act of October last, was issued July 31. Under the terms of this treaty all meats, except smoked, fish, fruit and ice, among many other articles, will be admitted from the United States to Cuba and Porto Rico islands free of duty, and butter and cheese on payment of 25 per cent ad valorem duty, after September 1. Into San Domingo ice machines also are admitted free of duty.

COLD STORAGE ITEMS.

ARIZONA.

Phoenix—The cold storage rooms introduced by D. L. Murray & Co. in their butcher business, have been so successful that the plant will have to be enlarged. Arrangements, therefore, have been made for the purchase of a refrigerating machine to cool with ammonia pipes.

CALIFORNIA.

Santa Barbara—Fisher & Co., market men, have just erected a cooling room to hold sixteen carcasses of beef, twelve of mutton, etc. The cooling is done by natural ice, 1,500 pounds being the guaranteed maximum weekly requirement. The walls are five inches thick, with one inch of asbestos lining.

FLORIDA.

Jacksonville—It is stated that S. S. Harvey contemplates establishing a cold storage plant.

ILLINOIS.

Chicago—The Manufacturers' Warehouse and Trust Co. was incorporated by R. L. Cresey, John B. King and John S. Pallen, August 13. Capital, $1,000,000. The plan proposed by the company is to furnish manufacturers storage for their products until sold, shipments being made direct from the warehouse. The building will be erected along the line of the Belt road, possibly at Stickney, the warehouse to be ready for use December 1. It is the purpose of the company later on to add to its project cold storage "under a new and improved system," the local papers say.

Jacksonville—Schoenfield & Co. are about to erect a brick cold storage house adjoining their ice factory.

NEW YORK.

Lewiston—Hall & Ferguson, of New York city, are erecting a cold storage house; capacity, 12,000 barrels.

TEXAS.

San Antonio—C. H. Brewster and J. Ward have rented a part of the Anheuser-Busch cold storage building, and will go into the business of keeping fish, meat and vegetables on cold storage, the business at present being more or less experimental, with a view to ultimate development in a separate building. The house will have a capacity for two cars of beer and two cars of general merchandise. The refrigeration is accomplished by mechanical means, no ice being used.

WASHINGTON.

Seattle—The Seattle Automatic Refrigerating Co. has increased its capital stock to $200,000, and 600 shares have been placed on the market to secure funds with which to erect additional cooling rooms to meet the large demand for cold storage.

WISCONSIN.

Eau Claire—Drummond Bros. will erect a cold storage warehouse shortly.

ICY ITEMS.

——The Tampa Fish and Ice Co. will remove their business from Port Tampa to Tampa, Fla.

——The Chester (Pa.) Ice Manufacturing Co.'s plant was sold August 1 by the sheriff, for $1,060.

——The Terre Haute (Ind.) Brewing Co. are selling thirty tons of ice daily in the city and adjoining towns.

——The Dallas (Tex.) ice factories are having a splendid season, all running at full capacity, while enlargements have been made in one or two.

——Mr. F. B. Woods, of the Woods Bros. Ice Co., of Kansas City, has returned to America after a residence of several years with his family in Europe.

——The Etowah Ice Co., Gadsden, Ala., shipping ice to Rome, have reduced prices at Rome from fifty cents per hundredweight to thirty cents per hundredweight.

——Jacob Weinberger, Fenelon Cannon, George Sealy and others have incorporated the Galveston (Tex.) Fruit Improving and Trading Co., with a capital stock of $250,000.

——On complaint of Jas. Cumberland, Gus. Senger, New York city, was held for trial on a charge of stealing 1,150 pounds of ice, for which he failed to account as peddler for Cumberland.

——Messrs. Daggs & Sandis, of San Francisco, are running a refrigerator wagon for the delivery of fresh meats and vegetables. The wagon is supplied with ice boxes and air chambers.

——John Wilson, of Norwalk, Ohio, P. A. Lang, G. B. Miller and others have incorporated the Bluefields Banana Co., to manufacture and handle candies, fruits, canned goods, etc., at Galveston, Tex.; the capital stock is $250,000.

——A Southern paper says: "An ice famine is reported from the enterprising town of Ocala, Fla. During the excessive hot days, when ice was in the greatest demand, the East Florida ice factory overtaxed its capacity and broke down. Owing to the growth of Ocala and adjoining villages, the present plant is unable to make enough for the local demand during the hot months, and there is an urgent need for another factory or increased capacity in the East Florida plant."

——The articles of agreement between the various ice companies comprising the consolidated company at Denver, Colo., known as the Colorado Ice and Cold Storage Co., were filed for record August 5. The companies were allotted stock in the consolidated company as follows: Rocky Mountain Ice Co., $10,000; Lake View Ice Co., $2,200; Spring Lake Ice Co., $2,200; F. W. Sylvester Ice Co., $10,000; Villa Park Ice Co., $10,800; Diamond Ice Co., $8,000; Denver Ice Co., $5,000; Argo Ice Co., $10,800; Adam Graff Ice Co., $18,000; Sylvester Ice Co., $10,000; Queen City Ice Co., $124,000; Union Ice Co., $72,000; Denver Artesian Ice Co., $47,000; Colorado Ice and Storage Co ,$270,000. The agreement, dated May 20, 1891, provides for monthly dividends, when the plant pays a profit, on the above scale. In addition to these companies the Zang Brewing Co was taken in on agreement not to manufacture its own ice, but to buy 1,000 tons a year from the trust. The life of the trust under agreement is fixed at ten years.

THE FIRE RECORD.

——C. F. Nelson's ice house at Bordentown, N. J., was burned July 29; loss, $2,000.

——The ice house of the Meriden Ice Co., at Highland House lake, near Middletown, Conn., was burned August 11.

——The Longview, Tex., ice factory was burned August 8. Loss, $6,000; no insurance. The factory will be rebuilt.

——Webster's creamery and ice house, at Calliope, Iowa, were recently burned. Loss, $1,500; insurance, $200.

——A small fire in the ice house of Mansfield & Dearborn, Worcester, Mass., August 6, damaged the ice in store $200 and the building $75; insured.

——Andrew M. Abbott's ice house, at Georgetown, Mass., with 8,000 tons of ice, a 40-horse power engine, tools, etc., were burned July 18. Loss, $15,000; partially insured.

——Chas. Pullen, of Atchison, Kan., suffered a loss of $2,500 by fire July 27, the roof being burned from one of his ice houses, and part of the contents lost; cause, spontaneous combustion.

——On August 16 an incendiary fired an ice house at Plainville, Mass., owned by Allen Smith, Jr. The house, which contained 1,200 tons of ice, was insured for $1,200. About 700 tons of ice melted.

——The ice house of Fred. Neese, near Mt. Holly, N. J., was burned July 29, the fire destroying building, 100 tons of ice, and all the tools for harvesting ice. Loss, $1,500; insurance, $600 on building, and enough on stock to cover loss on ice.

——The slaughter house and refrigerator of Alexander Mayboum, South Orange, N. J., was destroyed by fire on August 12. The buildings were two-story frame ones, and contained machinery, refrigerating apparatus and meat worth about $12,000. The refrigerator cost $40,000 and the buildings were worth about $6,000, making the total loss about $60,000. The fire originated in the boiler room. Large herds of cattle and sheep were in pens adjoining the buildings, and were rescued with great difficulty. The insurance is about $17,000.

THE LATE ROBERT MAYER.

A NEGLECTED GENIUS—HIS LIFE'S LABOR UNRECOGNIZED AND UNREWARDED—THE FATE OF A SENSITIVE MAN—TARDY HONORS PAID HIM AT LAST.

The accompanying illustration represents the marble bust of the late Julius Robert Mayer, in the garden of the Polytechnic Academy, in Stuttgart, Wurtemberg. As will be seen from the inscription on the pedestal, it was erected in 1889 by the Association of German Civil Engineers, in honor of the discoverer of the mechanical equivalent of heat, and the indestructibility of force, one of the principal bases of all modern natural philosophy.

Julius Robert Mayer was born at Heilbronn, November 25, 1814. He received a medical education, and became, first, county wound physician and afterward city physician of Heilbronn. But few particulars of his life have been obtained. In 1840 he made a voyage on a Dutch freighter to Java, and it was the accident of bleeding a feverish patient in that country, and observing that the venous blood in the tropics was of a much brighter red than in colder latitudes, that led him to those investigations of natural forces, the chief results of which are given in the following-named essays. Two years after his attention was drawn to the subject, in 1842, he published his first paper on the "Forces of Inorganic Nature." It was put together briefly, and published in Liebig's journal to secure the public recognition of his claims. His second publication, "On Organic Motion and Nutrition" (1845), an able essay of 112 pages, is not yet translated. His third paper, on "Celestial Dynamics," was published in 1848; and his fourth, on the "Mechanical Equivalent of Heat," appeared in 1851.



MARBLE BUST IN HONOR OF THE LATE JULIUS ROBERT MAYER.

Great and astonishing as Mayer's discoveries were, the indifference with which they were received by his own countrymen, and especially by the legitimate representatives of learning and progress, is even more so. The refusal of Prof. Poggendorf to publish his memorable essay in the *Annalen der Physik und Chemie*, which would have been the proper medium for its publication, is significant in this respect at the outset. Mayer had lived in the hope, says his friend and chief biographer, Ruemelin, that his scientific publications would find, if not assent, yet some attention and recognition among physicists. But seven years had elapsed since the publication of his first paper, four years since that of his first work, and a year and a half since that of his third, without his having received a single friendly word of encouragement from any one. Attacks, however, and derogating judgments there had been, but the bulk of the learned in physics took no notice whatever of his philosophy. Some disputed the priority of his discovery; others, its value. The English physicist, Joule, had, quite independently of Mayer and about a year later, found the equivalents of heat and motion by a method of his own, and determined the distance through which a body must fall in order to produce the unit of heat more correctly. He had, however, treated the question as a special problem in physics, and not drawn the general conclusions as to the indestructibility of the forces, and the other important results attached thereto. This was subsequently decided in favor of Mayer without prejudice to the independence of Joule. Mayer put forth his claim to priority in a letter to the French Academy of Sciences, and the *Comptes Rendus* (1845) reported on the relative claims of Mayer and Joule very impartially.

Four years after these discussions, and when Mayer's mind had suffered much from the events which we have described above, he was induced by the desire to secure priority, to publish in the extra sheet of the *Allegmeine Zeitung*, of May 14, 1849, a short notice, entitled "Important Physical Discovery," with his name attached, in which he announced that he had succeeded in finding a simple means to show experimentally the transformation of motion into heat; described the apparatus he had constructed to that end, and claimed the priority of the discovery of the principle of the transformation, against an article in the *Journal des Debats*, which had disputed it.

A week later there appeared in the extra sheet of the same journal of May 21, an article by one Dr. Otto Seiffert, then a privat-docent of physics at Tübingen, in which

Mayer's views were spoken of in an almost contemptuous manner. Among other things, the writer said, that for the professional man no discussion of Mayer's work was requisite, but laymen might find an explanation "according to the position of science" desirable.

Julius Robert Mayer, finding himself thus treated with rancor and contempt, without a word of comfort or approbation from any of those to whom his naturally affable mind looked for sympathy, unable by the habit and nature of his mind to liberate himself, even for a time, from oppressive thoughts by diversions such as constitute so common a resource of most mortals, became a prey to wounded pride and unsatisfied ambition. All arguments and entreaties of his family were in vain; the excitement rose to a real frenzy—an inflammation of the brain.

Mayer had now entered upon the dark period of his life. He lived twenty-eight years after the first attack of mania, and these years, says Ruemelin, must be considered as principally occupied by repeated outbursts of mental derangement. These had the character of mania, without delusions, or fixed ideas, and made it necessary, in view of what occurred, that he should be removed to an asylum. When he was somewhat more quiet he went to the asylum of his own free will. It appears that he was unsuitably treated at the lunatic asylum at Winnenden, and during the remainder of his life he expressed himself as greatly offended by what he had there experienced. In later years he visited the asylum at Kennenburg, where he was treated as a volunteer and guest, and not subjected to any restraint whatever. A few weeks of residence in this place had the effect of making him quiet for longer periods, during which he could return to his family.

In quiet periods he wrote several essays, such as the lecture which he gave in 1869 at the Scientific Congress at Innsbruck, "On Necessary Consequences and Inconsequences of Heat Mechanics," etc.

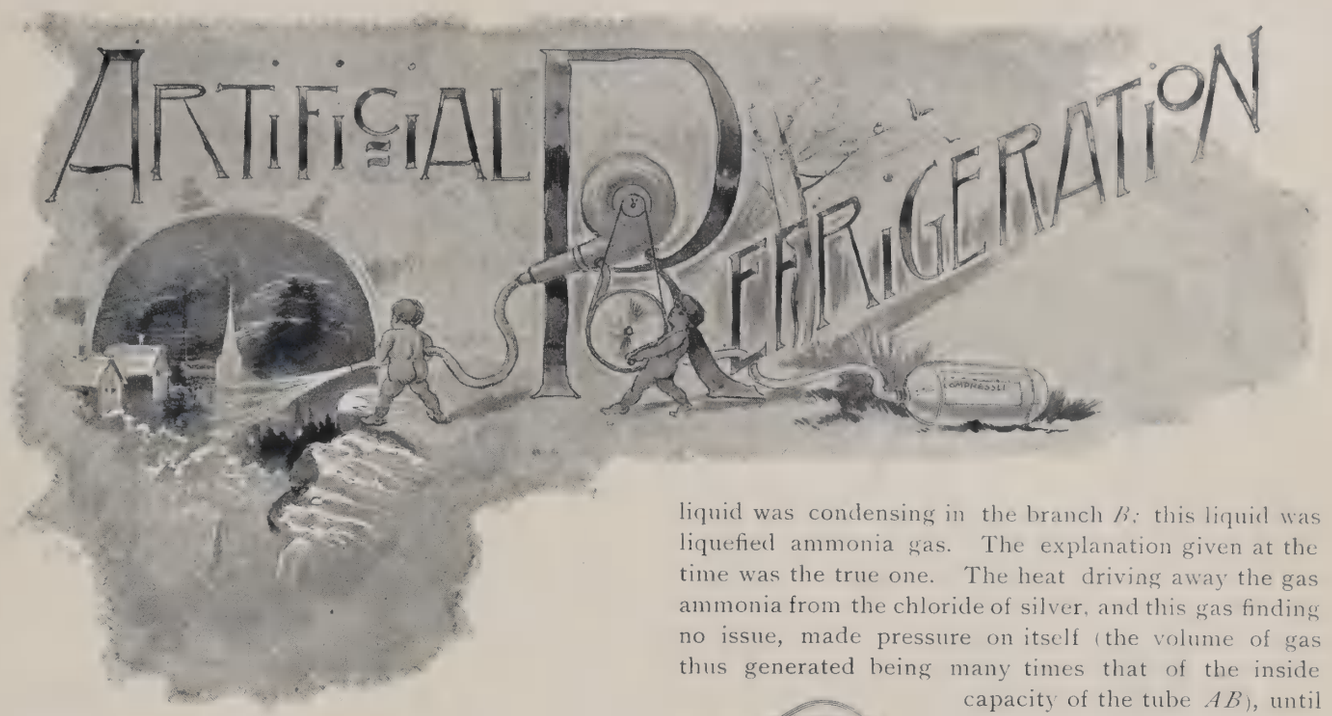
In later years he experienced much pleasure and satisfaction in seeing his work recognized; by feeling the glory which was to surround the recollection of his name; by finding himself honored as the first philosopher of his time; by finding it said and admitted that his discovery had effected an immense progress in the natural sciences, and had opened new fields of thought and action.

Schoenbein was the first to recognize the importance of his writings, to visit him and befriend him; and the first public manifestation of recognition which he received was the diploma of corresponding member of the Natural Science Association at Basle (1858). After this, attention was directed to him by Liebig, in an oration delivered at Munich on a festive occasion, and then a wide circle of savants began to take notice of his researches. The university of Tübingen, his *alma mater*, where he had taken his degree of doctor of medicine, also nominated him, *honoris causa*, doctor of philosophy and natural sciences. Diplomas arrived from Munich, Vienna, Tunis, Halle, Frankfurt, and from other learned societies too numerous to mention. The French Academy appointed him a corresponding member, and awarded him the prize Poncelet. The Royal Society gave him the Copley medal. In England he was mainly introduced to the notice of scientific circles by Tyndall, in France by Verdet, in Italy by Count St. Robert. Tyndall established closer relations with Mayer, and it was for Tyndall, and at his request, that Mayer wrote a short autobiography, from the draft of which Ruemelin has quoted, and we have repeated above some passages and data. In 1867 Mayer received the order of the Crown, and with it the title of personal nobility.

These late successes helped to give the evening of his life a happier aspect. But on the whole, says Ruemelin, Mayer must be added to the number of those men who pay for the benefits which they render to mankind with the happiness of their lives. No doubt the principal reason for his misfortune was an unfavorable disposition of the brain and mind: a very great excitability, and long continuance of the excited state; inability to divert his thoughts from an indifferent object, from an adverse impression, or from an injury received; and a rigid inflexibility of his will. But Ruemelin points out that it was not to the credit of German science—which was possessed of an immense apparatus for the attainment of its objects, numerous general and special journals in which the most insignificant performances still find room and praise, by accident or agreement—that a scientific discovery of the first order, one opening a new era in philosophy, should be liable to be kept out of sight by premeditated silence, or to be treated with contempt. This is mainly caused by the cohesion of cliques, and their trade protective principles, and in this enlightened age there still happens what is commonly imputed to the Dark Ages, that the innovations of genius are referred to the gratitude of later generations.

In later years the attacks of excitement became less frequent, and were very short. His children developed and gave him satisfaction. But his health began to fail, and in January, 1878, he was attacked with a serious affection of the lungs. To this he succumbed on the evening of March 20, 1878, when a quiet death, as his friend Ruemelin says, brought to this storm-tossed heart the desired rest.

Somewhere in the '30's, says the Bath, Me., *Times*, the ship Amazon, belonging chiefly to Gilbert Trufant, of Bath, was chartered by the Tudors, of Boston, pioneers in the ice business, to take a cargo of cold Kennebec product to Calcutta. For long voyages ice was packed a good deal differently from the manner which prevails among schooners for their coast trips nowadays. Bulkheads were set up at either end, made non-conducting by two feet of sawdust; similar protection was had along the sides, the ice was kept four feet from the bottom, and the deck was wet down twice a day. The great point was not to let the air into the lot. But when the Amazon, loaded with all this care, reached the hot latitude, the captain began to think how much more comfortable a little of the cool cargo would make him, and, with the reasoning of inexperience in these matters, he opened the cargo, helped himself to ice and made the hot days of the torrid zone pass quite pleasantly. When, however, he reached Calcutta and looked for the cargo it was nearly all gone. But few tons remained, and the vessel could get no freight money and was held for the cargo lost. The settlement resulted in the Tudors confiscating the ship for the ice they had lost (ice being very valuable in Calcutta, where it is sold by the pound), and the owners getting nothing.



[*Written for* ICE AND REFRIGERATION.]

ARTIFICIAL REFRIGERATION.

A CHRONOLOGICAL STUDY OF ITS DEVELOPMENT—ITS IMPORTANCE, ITS APPLICATIONS, ITS FUTURE.

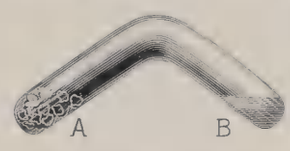
BY AUGUSTE J. ROSSI, B. S., C. E.

[*Continued from August Issue, page 93.*]

From the latter part of the last century, from 1770 to the beginning of the present one, when chemistry, abandoning the empiricism of alchemy, began to be an exact science, and the constitution of matter became gradually better understood, many gases, such as oxygen, nitrogen, hydrogen, ammonia, carbonic acid, etc., were isolated and studied, their nature or their composition determined, their properties ascertained. It was found that some of them, such as ammonia and carbonic acid, among others, could be liquefied and even solidified in certain conditions of pressure and temperature, and that the liquids thus obtained were the pressures over them, maintaining them liquid, relieved, would return to the gaseous state (their ordinary form of existence as known) generating by this transformation a very intense cold. It was observed also that certain solid substances, such as chloride of silver and chloride of calcium, especially the latter, could, in some manner not very well understood, absorb a very large quantity of this gas ammonia. Not much more than theoretical deductions were made of these observations at the time, and little was it thought then that on them would be based the industrial methods which have been since applied to the production of artificial cold or ice in unlimited quantity, and for any purpose whatever.

FARADAY'S EXPERIMENT.

However, Faraday made the following remarkable experiment: Taking a stout bent glass tube, *AB*, closed at both ends, he placed in one of its branches, *A*, before closing it, pieces of chloride of silver, which had been made to absorb ammonia gas to saturation and, heating the branch *A*, while the other branch, *B*, was cooled by being dipped in ice and salt mixture, he found that a liquid was condensing in the branch *B*; this liquid was liquefied ammonia gas. The explanation given at the time was the true one. The heat driving away the gas ammonia from the chloride of silver, and this gas finding no issue, made pressure on itself (the volume of gas thus generated being many times that of the inside capacity of the tube *AB*), until the pressure thus produced, assisted by the cooling of branch *A*, brought about the liquefaction of the gas itself by bringing closer together its elementary particles. This was demonstrating at once the possibility of liquefying a gas, such as ammonia, by pressure, but this was not all.



The lamp having been removed from the branch *A*, and this branch cooled in its turn, while branch *B* was exposed to the air, it was found that the liquid accumulated in the branch *B* immediately entered into ebullition and disappeared completely. In fact the volatile liquid ammonia began to give vapors by the cooling of branch *A*, and the pressure of these vapors and of these existing already in the tube being relieved by thus being absorbed anew, as fast as forming, by the cooled chloride of silver of the branch *A*, were exactly in the same condition as in the experiment of Leslie, but in this case, dealing with a liquid, the liquefied ammonia gas, much more volatile than water, the action was considerably intensified. No source of heat being present there to supply to the liquid ammonia that heat required and necessary to operate the change of state from liquid to gas, no other source at least than the inadequate one furnished by the surrounding air, it had to be borrowed for the greatest part from its own mass, and the temperature in branch *B* fell so rapidly and to such an extent that this branch was coated with a thick layer of ice by the freezing of the condensed moisture of the air on the cold side of the tube.

By introducing in the tube *AB*, in the branch *A*, or in a similar apparatus, certain substances capable of generating by their mutual reaction under heat or in the cold certain gases which would thus be confined and caused to make pressures on their own particles, Faraday succeeded in liquefying most of the gases known at this time. There was much in these experiments. It showed in a general manner the possibility of liquefying gases by pressure, or by pressure and cooling combined, and of using the liquids obtained for purposes of refrigeration. It showed also the possibility of alternately absorbing the gas, the vapors of a very volatile liquid in

a suitable absorbent, and expelling them by heat from this absorbent to condense the gas to the liquid state by the pressure exerted by the gas itself on its particles, promoting the operation by a suitable cooling, and then, by allowing the cooled liquid thus obtained to vaporize spontaneously by absorbing its vapors as fast as formed, by the original absorbent properly cooled, to produce an intense artificial cold. It proved also that ammonia, among other gases which could be thus liquefied, was capable of generating a considerable amount of cold by the evaporation of the liquid obtained by its liquefaction; and that, if used in conjunction with a proper absorbent, ammonia could produce such an artificial cold in a somewhat continuous manner were the apparatus properly contrived for such purpose. Insignificant, industrially speaking, as were the immediate consequences of this remarkable experiment at the time it was made, it has formed the basis of a special method of producing industrial cold by substituting water for chloride of calcium as the absorbent for gas ammonia—water, which is much better adapted than a solid for a practical application, and which, as is well known, can absorb enormous quantities of this particular gas, as many as 1,200 times its volume at a temperature of 32 deg. F.

But furthermore, this experiment, even in the conditions in which it was carried at the time, and in which chloride of silver was used as the absorbent, has been employed in our days with only a modification of the apparatus, and substituting chloride of calcium for chloride of silver as a cheaper absorbent, in such a manner as to produce ice in limited quantities, it is true, but still on what may be called yet an industrial scale for family use. The machine used has formed the subject of an American patent, of which we shall have occasion to speak.

The principles involved in artificial refrigeration, simple as they may be, after all, imply, as we can see from the above, a thorough knowledge of the constitution of matter, of its properties in the three states under which it manifests itself—solid, liquid and gaseous—and until such studies had been perfected—until the accumulation of knowledge, researches, observations of many centuries had enabled the following generations to reap the fruits of the unceasing efforts of the learned in preceding centuries, it is not to be wondered at if it did not make any serious progress for a long time. Indeed, up to the beginning of the present century, only such most evident laws of nature as could have been observed from times immemorial afford us examples of some efforts of application in this direction.

But even had such knowledge been acquired much longer before the lack of a handy, everywhere-ready mechanical power to obtain certain effects would have opposed a barrier to its development until the discovery of the remarkable properties of steam, of which the steam engine is the *resume*, were discovered. As is well known, the steam engine has had hardly one century of existence. The beginning of our present century, then, opens a new era, and discoveries followed each other in rapid succession in all the branches of human knowledge.

We have seen that substances known to exist only in the gaseous state at the ordinary pressure and temperature of the atmosphere were found to be susceptible of being liquefied and even solidified in certain conditions; water affords us an example of such substances which can assume the three states. The cohesion, the state of aggregation of the particles of a substance, goes increasing as it passes from the gaseous to the liquid state and from this state to the solid state. Gases expand readily, as we can observe, and at once in the atmosphere, and could not be kept in open vessels, while liquids may easily be retained in them, and solids do not require any envelope of any kind. Since heat vaporizes many liquids, it has a tendency to destroy this cohesion, and cold inversely must have, and has, a tendency to increase it. Pressure, by bringing nearer together the particles of matter, must act evidently in the same manner. From such observations easily made and controlled, as we have seen, by actual experiments, there was not a great effort required to conclude that, by both pressure and cooling combined, certain gases, if not all, could be liquefied, and this was proved by Faraday to be the case, as already stated, for a majority of the gases known at his time. Thilorier, later on, in an apparatus which bears his name, produced even as much as four pounds of carbonic acid in a solid state in one operation. The substances capable of generating carbonic acid gas, sulphuric acid and marble dust, having been introduced in a strong cast iron cylinder, very much like the apparatus used in our days for making carbonic acid water on a large scale, the gas, making pressure on itself in a special and distinct receptacle properly cooled, became liquefied, and by giving issue to the liquid thus formed, by the opening of a cock and collecting the liquid spray in a hollow half sphere of metal, the cooling produced by the spontaneous evaporation of a part of the liquid in the air (by the relieving of the pressure), was so intense that it solidified the remainder into a white ball of snow. So depressed was the temperature of this snow that, though it could be kept in the hand for a short while, it produced soon on the hand the same effect as a red hot iron would, disorganizing the skin. It could remain for a certain time in that state, but soon passed again to the liquid state, and then disappeared as gas, a thermometer inserted in the ball registering —110 deg. F., 110 deg. F. below zero F.!

In this case no absorbent was used to absorb the vapors. It is obvious from these experiments that similar liquids, thus or otherwise obtained, can only be maintained in that liquid state by being confined under pressure in a closed envelope, otherwise they would instantly vaporize and return to their original and normal state of gas at the temperature and pressure of the air. Were then the pressure over them, while they are thus confined, to be mechanically relieved partly or completely so as to reduce it to that of the atmosphere or below, they would instantly vaporize and, if placed in proper conditions, their temperature would fall to a very low degree, considerably below 32 deg. F. for many, as they would have to borrow the heat necessary for this change of state from their own mass. In the case of carbonic acid a temperature of —110 deg. F. was thus reached. If now we conceive such a liquid, properly chosen, to be confined in a close metallic reservoir under pressure, and this reservoir to be surrounded by water at ordinary temperature, if, by a proper mechanical device such as an exhausting pump acted on by a steam engine, for instance, we relieve the initial pressure to any important degree, the liquid will enter into ebullition, will give

vapors. The heat necessary for this change of state having to be borrowed from somewhere, and no other direct source of heat being available, the liquid will supply it first at the expense of its own temperature and indirectly at the expense of that of the water surrounding the reservoir containing it. With proper proportions of the volatile liquid and of the water surrounding it, it can be conceived that the temperature of this water may be caused to fall much below the freezing point—in other words, that ice will be obtained. The water may be indirectly cooled by placing the reservoir containing the volatile liquid in a non-congealable bath, such as a strongly saturated solution of salt, in which bath molds containing the water to freeze would be immersed, but the operation of cooling proper, though still more indirect, would be exactly the same. Were such operation continued for a certain time in those conditions the reservoir containing the volatile liquid would, sooner or later, be emptied, and no more cold could be produced. But we know that a proper degree of pressure and cooling can liquefy the vapor, the gas, thus generated. If, then, our exhausting pump is so combined that, after having removed the vapors forming pressure over the liquid in the reservoir, it can compress them and deliver them as fast as aspirated in another vessel distinct from the reservoir, in a condenser properly cooled by running water, we readily realize that, under this double action of cooling and compression, the vapors will return to the liquid state reconstituting the original liquid, and that they will be maintained in that liquid state by the pressure thus created in this condenser. It is easy to conceive such an arrangement as would allow the return to the first reservoir of the liquid thus reformed in the condenser so as to supply over and over again the quantities evaporated. Such is the whole theory of the system of refrigeration by mechanical compression, as it is called in our days. The liquids chosen, the mechanical contrivances adopted, may vary, but the principle is the same.

(TO BE CONTINUED.)

NEW REFRIGERANTS.

In 1889, Messrs. Tichborne, Parley & Purcell, of England, took out a patent for the "Utilization of Carbonic Acid given off during Fermentations," the patent covering the collection of the gases given off during fermentations in breweries, more especially, into proper receptacles, the alcohols and ethers being subsequently separated from the gases in a scrubber or by means of a spray of water, when the gas is cooled and compressed to a liquid and stored. A company to utilize these by-products was formed, known as the "Brewers' and Distillers' CO_2 Co.," but when the company's shares were put on the market, a London financial paper rather threw cold water on the scheme, as a desirable investment, which of course precipitated a discussion of the patent's merits. Of this discussion one point raised in defense of the patent may be of interest, and that is the one dwelt upon by Percy R. Allen, 2 Victoria Mansions, Westminster, who says :

"Referring to this process, I would venture to suggest that one of the most important applications has been rather overlooked, and this is the use of CO_2 as the cooling agent in refrigerating cars for the transit of chilled meat, fruit and perishable articles. I have had a very considerable experience in mechanical refrigeration, and know from personal experience the trouble and annoyance arising from the use of ordinary ice bunker cars. As a matter of fact, the weight of ice required to stock a car starting from Kansas City or Chicago to the seaboard is a large percentage of the dead weight of the car, added to which there is all the inconvenience of melted slush, and consequent rotting of the bunkers, and, moreover, such cars are very frequently unable to obtain return freight, owing to the peculiarities of their construction. Now it seems to me that this CO_2 system lends itself most admirably to cold storage cars, as the drums holding the liquefied gas could be placed under the car and the piping arrangement placed flat against the sides or circles, with a great saving of dead weight and space, compared with real ice. There is no doubt that rapidly increasing development of the chilled meat trade in this country demands a really good system of refrigerating cars, and this would seem to lie in the direction I have indicated."

***

M. Ducretet has devised an apparatus which, by the expansion of liquid carbonic acid, produces quickly a fall of temperature to 70° or 80° below zero C. It consists of two concentric vessels, the inner of which contains in alcohol a serpentine metal tube which connects by a tube with two stop-cocks with the carbonic acid reservoir outside, and opening below into the spaces round the inner vessel in which are pieces of sponge saturated with alcohol. This double-walled vessel is inclosed within a box. One stop-cock is opened wide, the other slightly, carbonic acid passing through the coil like snow, and turning to gas with great temperature reducing effect. Any of it not vaporized in the coil is dissolved by the alcohol in the sponges, and finally the gas escapes through the tube passing through the outer box. The apparatus is called a *cryogen*.

PIPE LINE REFRIGERATION.

The advantages claimed for pipe line refrigeration over the older methods with ice may be epitomized as follows: "The direct expansion of a liquefied gas produces quicker freezing, and makes it possible to maintain a uniform, dry, cooling temperature. A ton of regulated dry refrigeration can be delivered through a pipe cheaper than a ton of ice can be delivered by a team, and a ton of melting ice will only do three-tenths as much of the work required as a ton of dry, regulated refrigeration. Ice can be made by this system at the same time that the plant is in operation for cold storage and pipe line work, making the cost less than by other processes. A dry atmosphere is one of the most essential conditions in preserving food, it being possible to preserve meat even in a warm atmosphere for an almost indefinite period, so long as it is kept dry. Water and vapor from melting ice or brine of a fluctuating coldness saturate the contents of ordinary refrigerating chambers. The damp air absorbs the odors of various dishes, and communicates them to each other, all of which is avoided by dry refrigeration."

In Siberia the cold in winter is so intense that meat defies the butcher's knife, and some of the salesmen place their animals in fantastic positions before freezing them.

PROJECTED PIPE LINES.

The Pennsylvania Cooling Co., of Allegheny, Pa., are constructing a plant in that city to furnish artificial refrigeration through a system of underground pipes to each residence and store in the city. The Allegheny market house is now being fitted up with the system, and in a short time it will be ready for operation. The company will first supply the butchers of the market, and, if successful, will extend its plant and supply all who want it, having already obtained right of way from councils to lay pipes through the streets. The system, which is a patent of Edward Armstrong, late chief of the department of public safety, consists of a main line, with connections for each individual, running through the ice box and out, and rejoining the main pipe. The fluid consists of salt water or brine, treated in the same manner as manufactured ice. When it reaches from 20 to 30 degrees below freezing, it is forced through the pipes, making the circuit of the lines and back to the plant again. The connections to the ice box consist of coils of pipe, which take up very little room, and freeze everything in it. The officers of the company are A. J. Laurence, president; W. A. Ford, secretary; C. H. Hetzel, treasurer; directors, Samuel Grier, Barton Grubbs, R. C. Tannehill, J. C. Hetzel and James McAfee.

* * *

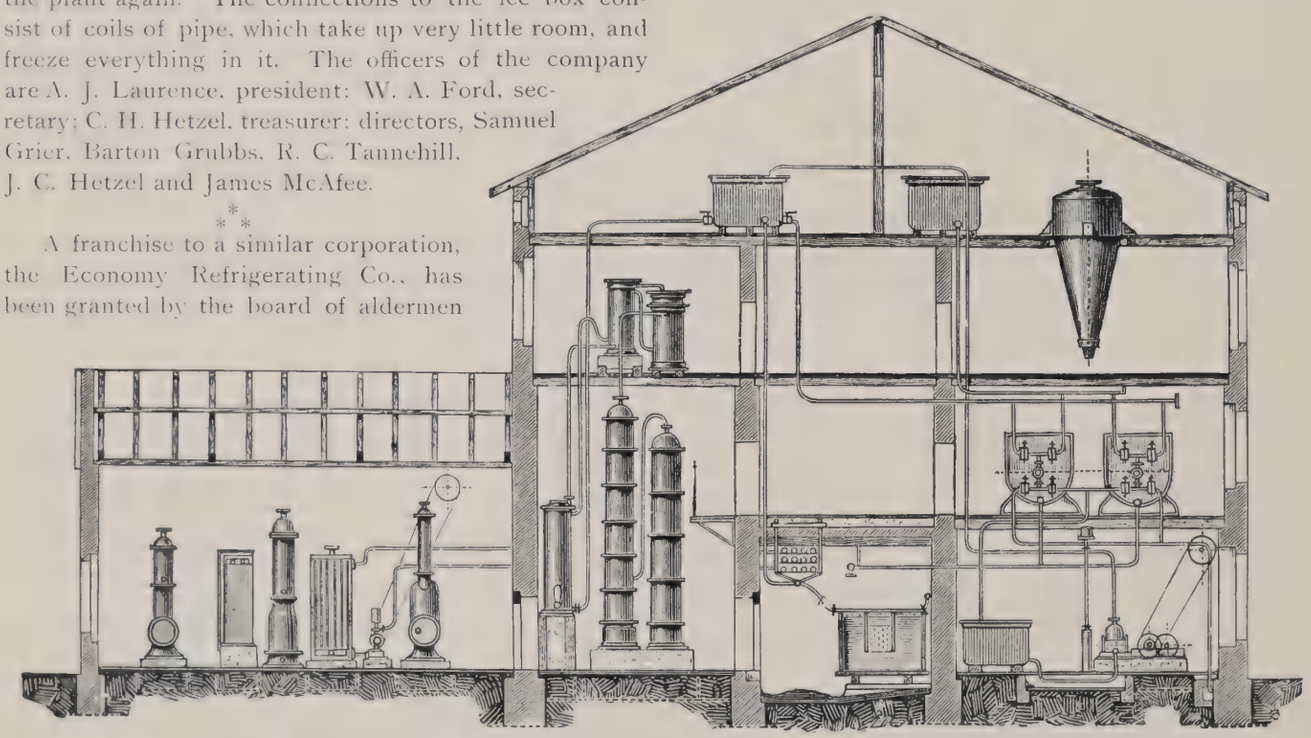
A franchise to a similar corporation, the Economy Refrigerating Co., has been granted by the board of aldermen of Brooklyn, N. Y., the mayor permitting the ordinance to become local law without his signature. There was the usual newspaper howl about giving away valuable franchises; but it does not appear that any one was willing to give anything for such a privilege, this idea in artificial refrigeration being as yet too much in the experimental stage to warrant a very great investment for franchise privileges only; although, undoubtedly, the idea is practical and will soon be commercially valuable and in extensive use.

* * *

The Kansas City council has been applied to for a franchise by E. H. Phelps and others, of that city, legally known as the O'Keefe Public and Private Combination Refrigerator Co., to lay refrigerating brine conduits through certain streets of that city to provide refrigeration from a central plant. The projectors say that 2,000 feet of conduits will be laid inside of two years, and that work thereon will begin within six months. The company say they will begin work inside of thirty days. The process to be used is the O'Keefe process of brine circulation. The St. Louis Automatic Refrigerating Co. has also applied for a similar franchise in the same city.

DISTILLERY ARTIFICIAL REFRIGERATION.

In the manufacture of spirits artificial refrigeration can be used in a similar manner as in the brewery. In the distillery also, at times, a refrigeration of certain rooms, as, for instance, the fermenting rooms, becomes necessary. This, of course, can be accomplished in the same way as in breweries, either by introduction of air, direct expansion or cooled brine circulating in pipes. In many cases it becomes also necessary to effect a quick refrigeration of the mash, which is done by cold water circulating through pipes. In these cases the cooling water may also be furnished by artificial refrigeration. Such water may also be used in place of ice swimmers, etc. More especially is the water cooled by artificial means applicable for the refrigeration of the distilled spirit, which should be done as quickly and as thoroughly as possible in a distillery. The accompanying sketch shows a sectional view of a distillery arranged with artificial refrigeration. The cooled brine is used for the refrigeration of the fermenting rooms, cooled spring water is used for pocket swimmers in the fermenting tubs and also to cool the mash and the product of distillation.



SECTIONAL VIEW OF DISTILLERY ARRANGED FOR ARTIFICIAL REFRIGERATION.

An artificial ice rink has been prepared for the amusement of the sons of Emperor William, of Germany, in the garden attached to Schloss Bellevue, in the Thiergarten. The young Crown Prince and Prince Fritz are good skaters.

Mercury freezes at 40 deg. below zero. Whenever the thermometer correctly indicates that temperature, mercury will freeze. Sometimes, though very rarely, that temperature is reached in the United States.



NATURAL ICE NEWS.

The hot weather which began late in July, and extended through the month of August—parts of which month gave the country a roasting such as is seldom experienced north of the fortieth parallel—gave a decided impetus to the ice trade; and in the great Maine fields the market has been better than for a year or two.

"Along the Penobscot, the ice business," says one correspondent, on the 10th of August, "is dull, although one coming up the river would think that a large amount was being shipped. There are numerous vessels loading, and among them more four-masters than have been seen here at one time for a long while. Ice has been going a little slowly, however, few sales being made for over eighty cents, while some were not quite up to that figure. A good proportion of the ice now being shipped is to fill contracts covering a term of years, and at a small sum." Another writer, a few days earlier, says, however: "The continued activity of the ice trade on the Penobscot is simply a hint of still better business to come. If signs do not fail all of the ice houses will be filled this winter."

There is no mistaking the activity on the Kennebec, however. A Gardiner correspondent, August 7, says: "It is a general impression that ice shipments from the Kennebec this season have been small, and but little if anything is being done by the ice companies. The talk that has been made in the papers about ice machines has led people to suppose that in a short time Kennebec ice would be left in the river, and that the valuable ice plants would become worthless. A day along the river last week among the ice houses presented a different appearance, at present, at least. We found at all the different ice houses fifty-one large three and four-masted schooners, loading and awaiting cargo. Few were of less than 600 tons, and many were of over 1,000 tons carrying capacity. On the whole, the fleet would carry off something over 30,000 tons. Not one of these vessels cost their owners less than $15,000, and several cost over $60,000, therefore quite a sum of money lay at anchor in the river.

"There were fourteen different crews loading, each having some forty-five men at work, making in all some 630 to 650 men. The companies are paying from $1.75 to $2.25 per day for labor, according to what position each man fills. An average rate would be about $1.87½.

"The various companies have shipped about the following amount:

Captain Rich, Farmingdale	35,000
Knickerbocker Ice Co., Old Orchard	Emptied
Knickerbocker Ice Co., Farmingdale	Emptied
Knickerbocker Ice Co., Randolph	3,000
Haynes & Lawrence, Randolph	6,000
Knickerbocker Ice Co., Smithtown	50,000
Great Falls, Pittston	25,000
Independent, Pittston	35,000
Clark & Chaplin, Pittston	30,000
E. D. Haley, South Gardiner	20,000
Arthur Berry, Dresden	20,000
Cochran & Oler, Dresden	40,000
Haynes & DeWitt, Iceboro	35,000
Knickerbocker, Iceboro	20,000
Morse Ice Co., Lincoln	Emptied
Morse Ice Co., Modock	10,000
Morse Ice Co., Island	Emptied
Morse Ice Co., Richmond	10,000
Russell, Richmond	Emptied
Russell, Richmond	15,000
Russell & Co., Dresden	20,000
Knickerbocker, Swan Island	Emptied
Clark & Chaplin, Bowdoinham	20,000
Pine Grove Ice Co., Bowdoinham	Emptied

"Already several houses have been shipped all out, and repairs are under way to fit them for next winter's filling.

"The Morse company are putting their Gardiner and Pittston houses in shape to fill the coming winter, and are building a shipping run at the Pittston houses.

"The Knickerbocker company commenced building a shipping run at the Chelsea houses Monday.

"It is said that the Clark & Chaplin Co. will rebuild the Bowdoinham houses this fall.

"Nothing has yet been done by the Knickerbocker company toward rebuilding the Farmingdale houses that were burned this summer. This is too good a property to be allowed to lie idle a great while, and it is expected that a new house will be put up this fall or winter."

It is safe to say that a big crop will be harvested the coming winter.

——Jos. Strope, Keokuk, Iowa, is building a new ice house, 80×100 feet.

——Palmyra, Wis., is shipping ice to Chicago at the rate of three to four cars daily.

——The Union Pacific Railroad Co. is rebuilding the ice house at Ogden recently burned.

——The Kinney, Force & Little ice house, recently burned at Struble's Pond, N. Y., will be rebuilt this fall.

——The Moline Ice Co., Moline, Ill., has closed a contract with Armour & Co., packers, to supply several of their local depots with ice.

——The Independent Ice Co. has been organized at Denver, Colo., to compete with the Denver Ice and Cold Storage Co., selling Buffalo Park ice.

——Mullon & Sons, of Albany, have bought the site of the old Wilbur ice house at Bath, and will build a house there, to be filled next winter.

——The large ice houses owned by Moore & Roby, Manchester, N. H., have been taken down, and the lumber will be utilized in building operations now under way.

——All the ice in the lower houses of F. W. Ayer & Co., Bangor, Me., has been shipped, and it will not take long to empty the upper houses. At the upper house the barge S. R. Meade is taking a cargo of 1,500 tons for Philadelphia.

——One of the large ice houses between Lake Village and The Weirs, N. H., which was partially demolished by snow last winter, is being repaired. It is the intention of the owners to fill their houses with Winnipiseogee ice the coming winter.

——Several of the ice houses of the J. F. Woodbury Ice Co., Bangor, Me., built two years ago, have tumbled or been torn down, and during the past month another was demolished, leaving several hundred tons of ice exposed to the weather. Only one more house owned by this company still remains standing.

——The Chautauqua Ice Co., of Pittsburgh, Pa., will soon begin the erection of a seven or eight-story addition to their already large building on Pike street, tenth ward, upon the completion of which radical changes will be made in the present structure to bring it into line with modern ideas and requirements. The addition and improvements will cost in the neighborhood of $125,000.

——There would seem to be plenty of ice in Salt Lake, for a local paper says a prominent dealer of the city is making twenty-five tons of manufactured ice per day, and is besides bringing down three car loads daily from the Parley's canon ice houses. As the company has seven houses up there full of ice, and the other dealers are well supplied with the frozen product, there is not much danger of any shortage this trip.

——The Arctic Ice Co., Messrs. Nicholson & McNaughton, proprietors, at Winnipeg, Manitoba, was organized in 1883, with storage houses for 2,000 tons, which has been repeatedly increased until now their houses hold 5,000 tons. They do a large ice business in mid-winter by supplying ice to consumers for melting, the melted water, free from alkali, being preferred to the hard water supplied by the water company. They also supply the Canadian Pacific Railway. Both gentlemen are natives of the province of Quebec, and both are quite young men.

TRADE CORRESPONDENCE.

A GOOD LOCATION FOR COLD STORAGE WAREHOUSE—EVOLUTION IN ICE MANUFACTURING—A QUESTION FOR ICE MANUFACTURERS.

[The publishers of ICE AND REFRIGERATION do not hold themselves responsible for the opinions expressed by correspondents on any topic; but these columns are at all times open for the discussion of subjects of interest to the trade. Our readers are cordially invited to contribute to this department by giving their views on questions propounded, or by suggesting original topics for trade discussion. Anonymous letters will receive no attention whatever.—ED.]

A GOOD LOCATION.

CENTRALIA, ILL., July 30, 1891.

To the Editors of ICE AND REFRIGERATION:

GENTLEMEN.—In reply to your inquiry concerning the organization of a cold storage company—a company was organized here last winter, but no factory has been built. The projectors dropped it, stating that next year they would go ahead. Pittinger & Davis, coal miners and ice dealers, were the chief projectors.

In this connection I will say that Centralia is a most important point for ice making and cold storage. All, or nearly all, the ice used in this section is shipped in from the north, or from ice factories. Centralia has railroad connections with competing lines to all points, and is the center of the largest fruit producing region of the west. In the immediate vicinity of Centralia there are thousands of acres of apple and other orchards, some bearing and others new. A cold storage house would be filled to its utmost capacity. Fruit shipped from Centralia, that goes into cold storage in Chicago, would, if gathered in one place, more than fill any one storage house there. One of our fruit dealers last winter had fruit in cold storage in nearly every important city in the west. All the necessaries for such an enterprise are here in abundance—cheap fuel, plenty of water, shipping facilities: in fact, everything that could be desired.

I have mentioned these points in the hope that if any one interested is desirous of finding a location for such an institution, they will take Centralia into consideration. C. D. TUFTS.

EVOLUTION IN ICE MANUFACTURING.

The term evolution is nowadays employed to denote a progressive unfolding, or growth; and describes in a very complete way the history of all important machines and processes in industrial development. This evolution is not an ideal matter; on the contrary, it is a business one that must be taken into account—the same as taxes or an expense account. Every improvement of any importance comes down to a standard of "Common practice through a course of evolution."

The improvements in machinery for the manufacturing of ice have been no exception to this rule, but have in a few years developed from the inefficient to its present comparative efficiency. Failures have marked the pathway to the results which have crystallized into "common practice," but invention is still on the alert.

"Common practice" has settled on ammonia as the best agent to absorb heat (or generate cold), and as it is a very subtle gas "common practice" has adopted the use of extra strong pipes and fittings, engines and compressors made with extra care and strength to hold and circulate it, as the only means of preventing waste and loss of so expensive an agent. "Common practice" has established two different systems of circulating the ammonia. One, known as the compression system; the other as the absorption system. Both are successfully used for that purpose.

"Common practice" has settled on two systems of freezing: One, known as the can system, is very generally used; the other as the plate system, the ice from which is very superior. In both of the above systems brine is used as a secondary medium to transmit the cold obtained by the expansion of the liquid ammonia into gas to the water to be frozen. Brine is expensive and wasteful, as well as destructive to the metals with which it comes in contact. To avoid this, freezing cells on the plate system have been made, with the ammonia pipe coils fastened to and between two iron plates, no attempt being made to have the cells water tight. All that have thus been made are working very successfully, doing more freezing per square foot of surface than those using the brine; and the cost of such cells is less than the brine cells. Some inventors have gone a step further, by freezing directly on the coils of pipes. In this case the chilling current has only about one-eighth inch of metal to pass through to its work; but the difficulty has been heretofore to harvest marketable blocks of ice from such irregular surfaces as the coils of pipe present. That difficulty is very nearly if not quite solved. When this is done there would be no further use for brine or plates. It would also apply to the can system. Distilled water, indispensable to producing good ice in the can system, would not be required, as with the less expensive filtered water better ice could be produced if the cans are removed. These improvements, thus gradually developed, may ere long be crystallized into "common practice."

The essential elements of commercial success in the ice business are: A near-by market, cheap power, the best machinery and a liberal supply of pure, cold water. (Artesian wells are quite sure to pay a good percentage on their cost.) These requisites, coupled with judicious management, are about as certain to return a reasonable profit as any other business if confined within the limits of the middle, western and southern states. Manufactured ice is rapidly becoming popular with consumers. A feeling is pervading the community, in most cases well founded, that natural ice often contains the germs of disease; and as the population increases in the vicinity of the sources of supply of the natural article, it is more and more liable to contamination. It needs but little foresight to predict the effect of this in the near future, coupled with the increased supply of manufactured ice, of pure quality, at low cost.

This evolution is not an ideal matter; on the contrary, it is a business one that should be "taken into account" by those whose interests will be affected by the change.

LEA PUSEY.

QUESTIONS FOR ICE MAKERS.

Is there any economy in adopting the Corliss engine to furnish the power requisite to drive the compressors, either single or double-acting, for ice making alone? Experience has necessarily taught us, both as proprietors and engineers of ice making plants, that to enable us to make a marketable and serviceable ice, it should have as near or even a better appearance than lake ice has. To produce this effect, after various and expensive experiments, we find ourselves compelled to adopt the now prevailing idea of using the condensation either from the exhaust or from live steam from the boilers, as the case may be, usually termed distilled water.

Now the first question is, providing we endeavor to use our exhaust exclusively for producing enough condensation to supply, say, a 50-ton plant, we find from experience, that by using the common double-ported slide valve engine as the driving power of the compressors, we had a sufficient quantity of condensation to make our full capacity per twenty-four hours, with none to waste; on the other hand, where we used the Corliss engine, we found that, to supply the deficiency of water from the condensation of the exhaust, we were compelled to run a live steam pipe directly from the boilers to the condensers for the purpose of supplying the condensers with more steam.

Without stopping to discuss the origin of the steam, for which we must look to the coal pile, as in every other case, let us suppose that we are limited to a supply of cold water. We know that exhaust steam, after it has thrown the percentage of its original power to the engine, would be much easier condensed, and with a great deal less water, than steam taken directly from the boilers; so that a question of cold water must now enter into the calculations. If we must use more cold water, which is very often very costly, it certainly must be added to the first cost, so that we now come down to the mere supposition, if we use the Corliss engine, recognizing its superiority over any other engine of the slide valve make, we will have considerable study to discover which is the most economical.

These questions would not apply with the same force where an abundant supply of cold water can be obtained, knowing the remarkable facility whereby we can absorb heat by the application of cold, so that in case of being compelled to use live steam it would readily be absorbed simply at the cost of the steam. The above proviso as to an abundant supply would be the exception to the general rule, as from the writer's experience, he has found any additional supply over a limited quantity was at a considerable additional cost, so that now, with all things considered, as first cost of machine, supply of cold water, wear and tear, liability to accident, and cost of repairs and stoppage (the last a very expensive matter in ice making) must all be left to the judgment of those using machines and those anticipating using them. Differences of opinion always will exist, and no doubt it is well they do, as these differences always leave an opening for the student; and the object of these questions is based on a plain mechanical experience, without prejudice or partiality to any one of the numerous and meritorious ice machines and condensing devices. ALEX. GIBBONS, *Engineer.*

U. S. A. ICE MAKING.

BROWNSVILLE, TEX., August 20, 1891.

To the Editors of ICE AND REFRIGERATION:

Ice manufacturing here has been unprofitable this year. The business is very limited, and there being two local companies, besides the two machines at post Fort Brown, the business has been divided up so that the town machines will stop operations. The Frontier Ice Works have done so already and the Rio Grande works will soon have to do so.

The government, through the Hospital Department at Fort Brown, are guilty of obtaining and holding the largest consumers. Their facilities for making ice are such that they can cause the machines in town to run at a loss or stop. We consider that under an administration that has for one of its cardinal principles *protection* to home industries, wherever she has the power to prevent an injury to private enterprise in manufacturing, she herself should not be a competitor for local trade in making ice, and thus cause loss to private capital invested in ice plants.

FRONTIER ICE WORKS.

——The Kansas City packing houses take credit for exporting to Europe 5,000 cars of pork annually.

ICE AND REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE AND THE TEXAS ICE MANUFACTURERS ASSOCIATION.

·.· SEPTEMBER, 1891 ·.·

SUBSCRIPTION PRICE, $2.00 PER ANNUM.

H. S. RICH & CO.
PUBLISHERS,

177 La Salle St., Cor. Monroe, CHICAGO.

206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

Entered according to act of Congress, in the year 1891, by H. S. RICH & CO., in the Office of the Librarian of Congress, at Washington, D. C.

SEND IN YOUR SUBSCRIPTION.

If you have not already subscribed to ICE AND REFRIGERATION, *your attention is directed to the inclosed subscription blank, which we will be pleased to have you sign and return. If you are a subscriber, please hand subscription blank to some one who may in any way be interested in the subjects covered by* ICE AND REFRIGERATION.

MORE GOOD WORDS.

The publishers have received so many expressions of hearty commendation for good work that it would be most uncourteous not to acknowledge them. We have heretofore published a large number of such kindly letters, and herewith print a few more, as an expression of our appreciation of the thoughtfulness of our friends in thus expressing their approval of the work thus far accomplished by ICE AND REFRIGERATION. We again thank the writers, and assure them, as all other readers of this journal, that we shall still further demonstrate that ICE AND REFRIGERATION will ever be in the van of all that is of interest in the field of ice and refrigeration in all its branches.

[JAS. A. SMITH, St. Louis.]

You have "struck it rich"—you have a "big thing on ice."

[LOUIS A. HAUSTETTER, Pres. and Supt. CONSUMERS ICE CO., Philadelphia.]

We most cheerfully subscribe to ICE AND REFRIGERATION—a needed journal to ice manufacturers, providing the proper interest is always displayed for the interests of the trade, to which I consider you have made a noble effort. We heartily wish you great success.

[A. L. DORR, Genl. Supt. DIAMOND ICE CO., Wilmington, Del.]

The first number of ICE AND REFRIGERATION has been read and greatly appreciated.

[THOS. A. SCOTT, Philadelphia.]

I am more than pleased with ICE AND REFRIGERATION. As I have been in this business a number of years, and always look for new information on the subject, I consider your journal just what we need.

[GARLOCK PACKING CO., Palmyra, N. Y.]

Vol. I, No. 1 of ICE AND REFRIGERATION is received, and we consider it the finest specimen of trade journalism that has ever come under our eyes. * * * Our advertisement shows the marks of an artist, and we are more than pleased.

[FORT WORTH ICE CO., N. WALLERICH, Sec. and Treas., Fort Worth, Tex.]

We received the first copy of ICE AND REFRIGERATION several days ago. To use a hackneyed expression, it undoubtedly "fills a long felt want." We read with great interest the article by John E. Starr, on "Non-conductors of Heat." Much good will result from these experiments. The most common defect in the construction of the average ice plant is in the ice house. We think we have already been benefited ten times the amount of the subscription price by the information contained in your first issue. We wish you "God speed" in your venture.

[W. S. WARE, Manager JACKSONVILLE REFRIGERATOR ICE WORKS, Jacksonville, Fla.]

Your first number of ICE AND REFRIGERATION was an instructive and thoroughly first-class paper. If kept up to that standard it must be a success in every sense.

[F. V. DE COPPET, Inventor of Ice Machines, New Orleans, La.]

Your journal is of the highest interest to me, having been indentified since 1868 with the first Carré machine put up in this country, and having made the first compression refrigerating ice machine of any record, using anhydrous ammonia, etc.

[J. W. ALLINDER, Cincinnati.]

I find ICE AND REFRIGERATION full of interest, and a valuable journal to those engaged in the ice and refrigeration business.

[CONSUMERS ICE CO., San Francisco.]

Allow us to congratulate you on your success in providing special information upon the subjects of ice and refrigeration, in the two numbers of your paper we have received. We do not know of any subject that people generally know so little about as machine ice and refrigeration; and you will deserve great public credit and esteem in pursuing the course laid out.

[GEO. W. DECKER, of Morris & Decker Manufacturing Co., Newport, Ark.]

I congratulate you on your production of ICE AND REFRIGERATION. May she never melt, but be able to stand all the breezes, be they hot or cold, and come out at the end of a useful life, well preserved under the influences of that which she represents! (No bouquets, thanks!)

[BIEMILLER ICE CO., Baltimore.]

We must say we are well pleased with ICE AND REFRIGERATION. We wish you much success.

[FRONTIER ICE WORKS, Brownsville, Tex.]

Your new publication, ICE AND REFRIGERATION, has been read by us. It fills a niche heretofore vacant, and a want long felt by all interested in the manufacture of ice. Now we have somewhere to look for all required information; for all that is new in improvements in ice machinery; an authority where questions can be asked and answered, which may be beneficial to others besides the inquirer; and where instructive theories and practice may be discussed. Your advertising columns will also be useful to your readers. May you be successful and prosperous with ICE AND REFRIGERATION.

[J. A. DOE, SOUTH OMAHA ICE CO., Omaha, Neb.]

I consider ICE AND REFRIGERATION a valuable journal to those engaged in the ice business, and supplies a long needed necessity.

[GEO. A. BURROUGH, Providence, R. I.]

I am much pleased with ICE AND REFRIGERATION. It is well gotten up, and about perfect in every respect.

[J. M. BASSETT, Supt. and Eng. WEATHERFORD LIGHT AND ICE CO., Weatherford, Tex.]

ICE AND REFRIGERATION fills a long felt want. I shall be pleased to give you my support and aid in any way I can.

[HUGH LOGAN, San Francisco.]

I have been handling refrigerators ever since 1854, and often looked for something good in that line; but I will give you the credit for striking the key note. "Long may you wave."

[A. H. HUTCHINSON, Kansas City, Mo.]

I must, among the rest, send you my congratulations upon the style of ICE AND REFRIGERATION, which, however, does not exceed my expectations after having known so long and well of your success with *The Western Brewer*.

IT IS commonly supposed that ice would be thicker on still water—a lake or reservoir, for example—than it would be in the mid channel of a swift river. According to observations made by the Davenport (Iowa) Academy of Sciences, however, when ice is nine inches thick on the lakes, the channel ice is eighteen inches thick on the Mississippi river.



SOUTHERN ICE EXCHANGE.

[OFFICIAL.]

W. J. Rushton, Pres. Birmingham, Ala. — C. W. Beise, Vice-Pres. Chattanooga, Tenn.

W. H. Howe, Treas. Nashville, Tenn. — A. Ellis, Secy. Columbus, Ga.

Southern Ice Exchange,
President's Office,
Birmingham, Ala., August 18, 1891.

Gentlemen: The Southern Ice Exchange desires to obtain reliable information regarding the volume and condition of the manufactured ice trade of the south, and request your answer to the questions appended.

It is believed that a thorough understanding of the condition of the business would prevent the erection of machines in various sections where the production already exceeds the demand.

No one for a moment doubts that the extraordinary season of 1890 has been a disastrous one to the ice manufacturers, by causing the erection of many unnecessary plants, and the consequent ruinous competition.

For investors in these plants there can be no adequate return on the investment.

The Exchange will publish the general information received of value to the trade in Ice and Refrigeration, Chicago, Ill., the organ of the Exchange.

Make your answers full, writing "confidential" after any information not for general use.

Also give information how ice is delivered, whether at the door or into coolers, whether you wash it for customers, whether you give "Bar Pieces" to your saloon trade.

How many deliveries per day, and any information of interest to the trade regarding business methods, books or tickets used, method of checking against drivers, allowance for leakage on wagon trade. Yours respectfully,

Box 6. W. J. Rushton, *President.*

QUESTIONS FOR THE USE OF THE SOUTHERN ICE EXCHANGE.

City..... State.....
Firm or Company.....
Number of machines..... Made by.....
When erected..... Actual daily production.....
Sales January, 1890, to July 30, 1890.....
" " 1891 " 30, 1891.....
Prices in 1890..... in 1891.....
Condition of trade in 1890.....
" " 1891.....
What do you estimate the cost of production per ton.....
What do you estimate the cost of selling per ton.....
(Not by the day, but for the whole six months.)
Has the investment been a profitable one?.....
Have your prices been affected by breweries or their agents selling or giving away ice?.....

LIVING ROOM REFRIGERATION.

It will be of interest to readers of Ice and Refrigeration, who recall the article in the July issue entitled, "Refrigerating by Street Mains from a Central Plant"—being a description of the system as operated in St. Louis, by the St. Louis Automatic Refrigerating Co.—to know that the company has had their system in operation for two or three weeks in their first living room, and that their experience so far has shown the system to be an entire success when utilized for this purpose.

The room so cooled is a restaurant and beer hall on the line of their street pipe line on Market street, between Third and Fourth streets. The restaurant has about 75×25 feet floor area, and was especially fitted up and decorated to carry out the idea expressed by the proprietor, who calls it the "Ice Palace" on his sign.

The walls have been covered by a scenic artist with representations of incidents in the Kane Polar Expedition, and also with sleighing scenes and other frescoes of a frigid character. The "expansion piping" is placed on the wall about half way between the ceiling and floor, in three sections, or grills. The show window is insulated with double glass, forming the front of a show box which contains the proprietor's name, made up of expansion piping, so that the letters are always covered with a heavy coating of frost, making a very striking appearance from the sidewalk. Such portion of the expansion piping in the room as it is necessary to use to maintain the temperature is also covered with frost, so that the *ensemble* is as pleasing to the eye as the cooled atmosphere is comfortable to the body.

No difficulty is found in maintaining any desired temperature in the room, no matter how crowded it may be or how warm the air outside. With the thermometer at 90 deg. to 95 deg. outside, the room is easily kept at from 68 deg. to 70 deg. This temperature has, however, been found to be a little too cool, as it was feared that so great a change might prove injurious to the health. A temperature of 72 deg. to 75 deg. has, therefore, been adopted, when the temperature on the street registers from 85 deg. to 90 deg. A small exhaust fan is used to remove the tobacco smoke and vitiated air, so that the room is at all times not only cool but clean and clear of all objectionable odors.

The company has finished their pipe line on Sixth street as far north as Olive street, and have their entire piping force at work piping and connecting up boxes on the new portion of the line. They will soon start laying pipes north from Market street on Second and Third streets, reaching into the butter and commission house district.

The publishers of Ice and Refrigeration would suggest to ice manufacturers the desirability of having this paper called to the attention of their engineers, all of whom should be subscribers, and many of whom would be, doubtless, if the paper were called to their attention.

NEW BOOKS.

Jahresbericht ueber die Leistungen der chemischen Technologie fuer das Jahr 1890. Von Dr. Ferdinand Fischer. Leipzig, 1891. Otto Wigand's Verlag. 8vo, paper, pp. 1242; price, M. 12.

This is the thirty-sixth annual volume of this series, which was commenced by the late R. v. Wagner, each volume giving an exhaustive review of the progress in the various branches of technological chemistry during the preceding year. The references on articles of food and drink alone cover a space of over 300 pages, and are a complete review of this subject. The value of the work is greatly enhanced by a system of exhaustive indexes.

Bacteriologische Diagnostik. Von James Eisenberg. Hamburg und Leipzig, 1891. Verlag von Leopold Voss. 8vo, paper, pp. 510; price, M. 12.

This work contains a systematic and classified description, arranged in convenient tables, of all bacterial forms, including fungi, and is doubtless a great help to any one interested in bacteriological investigations. An appendix of some fifty pages gives an epitome of the methods and processes employed in bacteriological research.

ANSWERS TO CORRESPONDENTS.

EFFECTS OF AMMONIA ON COMPLEXION—NATURAL AND MANUFACTURED ICE—THEORY OF COLD STORAGE—TO REDUCE TEMPERATURE IN COLD STORAGE ROOMS.

[This department of ICE AND REFRIGERATION will be conducted for the benefit of the trade generally, as well as individuals, and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

To the Editor: I have noticed lately in several papers and periodicals, short articles on the poisonous effects of inhaling or absorbing ammonia gas. Are there any foundations for these articles? I quote you the following from the Chicago *Tribune* of a recent date: "The effect of ammonia on the complexion is directly the opposite to that of arsenic. The first symptom of ammonia poisoning which appears among those who work in ammonia factories is a discoloration of the skin of the nose and forehead. This gradually extends over the face until the complexion has a stained, blotched and unsightly appearance. With people who take ammonia into their systems in smaller doses, as with their water and food, these striking symptoms do not appear so soon. The only effect of the poison that is visible for a time is a general unwholesomeness and sallowness of the complexion." F. W. A.

Answer.—We have tried to find the above-mentioned *Tribune* article, in order to ascertain on what authority it is based, but have not succeeded. From our own knowledge we can neither deny nor affirm the assertions made therein; but as far as the work around an ammonia refrigerating plant is concerned, we have never heard of any complaints akin to ailments mentioned in the above quotation. In ammonia factories, however, it may be a different thing.

To the Editor: (1) If you place two cakes of ice of, say, 200 pounds each, one of artificial ice and the other natural ice, in the ice box, which will last the longest length of time? (2) Is not artificial ice the purer?

Answer.—(1) It is held that manufactured ice is frozen more solidly than natural ice, *i. e.*, it contains less air, in which case it would melt more slowly than natural ice. (2) Ice manufactured of filtered distilled water is chemically pure; natural ice frozen on unpolluted water is probably equally as pure. Natural ice from polluted courses is likely to be impure; ice manufactured of impure water is also likely to be impure. To obtain pure ice in any way, pure water must be frozen. See article in August issue of ICE AND REFRIGERATION.

To the Editor: How is the action of cold storage in preserving provisions to be accounted for, or how is it explained? C. W.

Answer.—Simply by the fact that the fermentative changes, or decompositions, which cause the destruction of perishable goods, cannot proceed at the low temperatures maintained in cold storage establishments.

To the Editor: Can meat be kept from putrefaction in an atmosphere of carbonic acid, excluded from the atmosphere? H. B.

Answer.—If the meat could be sterilized, or freed from all bacterial germs, in some other way, it would keep in an atmosphere of pure carbonic acid gas; otherwise it would only do so in a measurable degree.

To the Editor: Is it possible, in your opinion, to keep a storage room as cool by ice as it is by artificial refrigeration? G. F. T.

Answer.—No, not with ice alone, but if the ice is mixed with salt, or if a brine made of ice and salt is pumped through coils in the storage room, it can be done; but, of course, this would be also a kind of artificial refrigeration.

To the Editor: How can I ascertain approximately the refrigerating capacity of an ice machine, brine system? K. H.

Answer.—Take the amount of brine which is refrigerated per hour, in pounds, multiply by 0.85, and with the difference between the temperature of the outgoing and incoming brine, divide this product by 11,830; this will give the refrigerating capacity in twenty-four hours, equivalent to tons of ice.



——The Denver Packing Co. has increased capital stock from $300,000 to $600,000.

——Work on the new stock yards between Minneapolis and St. Paul has been resumed.

——The new packing house for the Kingsburg Packing Co., Fresno, Cal., has been completed.

——The Keokuk pork packing house laid off forty-five hands July 28, on account of scarcity of hogs.

——The Bloomington pork packing house was damaged to the amount of $1,000 by fire August 7. Fully insured.

——A Nebraska City, Neb., paper says there are at present in the packing houses in that city 5,000,000 pounds of pork.

——J. F. Pierce, butcher and packer, at Lexington, Ky., will soon put a refrigerating machine into his packing house.

——A new packing house 49x137 feet, seven stories and basement, is erecting at Waterloo, Iowa, to be ready November 1.

——The Tennessee Packing Co. has established a branch packing house at Birmingham, Ala., under the management of Phillips, Orr & Ungerman.

——The Fort Madison (Iowa) Stock Yards Co. has been organized with capital of $100,000. The company will build stock yards and a large packing house.

——The new stock yards of the Northwestern railroad, at Pierre, S. Dak., are now ready for use, having accommodations for 1,000 to 1,500 head of cattle.

——The Columbus (Neb.) packing house was burned August 23; loss, $10,000; no insurance; cause, supposed to have been sparks from U. P. R. R. locomotive.

——J. E. Booge & Sons' pork packing house at Sioux City has been sold to the new Central Stock Yards Co., of that city, in which Mr. John P. Squires, of Boston, is largely interested.

——The Phœnix Packing Co., Kansas City, has received its new machinery, to be used in the hog killing department. The company will erect a building which will be used exclusively for the curing and packing of hogs.

——The Colorado Packing Co.'s new establishment in the Union Stock Yards, Denver, is rapidly nearing completion. It is to be completed by September 1, at a cost of $250,000. The company has doubled its capital stock.

——The Cudahy packing house at Omaha, has purchased a smoking and cold storage plant in Los Angeles, and will ship meats in salt from the yards at Omaha, to be smoked in Los Angeles for the southern California trade.

——An incendiary attempt was made, August 14, to burn the large Durstand-Logaman packing house, in East Atchison, Kan., but the fire department arrived in time to extinguish the flames before a great deal of damage was done.

——Swift & Co., the great beef and pork packers, August 11 began shipping ice from their ice house at Ashland, Wis., to Omaha and Kansas City, handling about thirty cars per day, and will continue through the season. Their Ashland storehouse contains about 4,000 car loads.

——Mr. John W. Hackett, a well known stock dealer of Fort Dodge, Iowa, has removed to Keokuk, Iowa, where he has just closed a deal whereby he secures a site at the Keokuk Union Stock Yards, where he proposes to erect in the yards a beef packing house and refrigerator. He will begin in a small way and increase the business as occasion demands. He will, as soon as preparations can be made, kill and dress beef for the local dealers, and for shipment, as well as handle live stock.

——The Southwestern railway association has advanced rates on live hogs from Texas to Kansas City from forty-three cents to fifty-one cents. When the rate was forty-three cents the packers at Forth Worth could come to Kansas City and buy live hogs, and, after shipping them to Forth Worth, could sell the product as cheap and cheaper than the Kansas City packers. With the advance the Fort Worth packers will be shut out of the business in buying in the Kansas City territory, and the advantage in favor of Kansas City will be restored.

SOME MORE PRICES.

Bismarck, N. Dak., 20 c. per cwt.

Boston, reduced to one-third to one-half last year's rates.

Pittsburgh, Pa., last year's rates reduced by one-half.

Fall River, Mass., 20 lbs. daily, 50 c. per week; 50 lbs. daily, $1.00 per week.

Newark, N. J., 45 lbs. per week, 30 c.; 120 lbs. per week, 75 c.; 30 lbs. or more daily, 50 c. per cwt.

Toledo, Ohio, maximum price, 40 c. per cwt.

The ice factories of Fort Worth, Tex., have advanced prices from 75 c. per cwt. to $1.

The Fort Payne (Ala.) Ice and Cold Storage Co., May 1, quoted wholesale prices f. o. b. as follows: Packed, any quantity, 60 c. per cwt.; loose in car, less than 5 tons, $9 per ton; 5 tons and less than 12 tons, $8 per ton; 12 tons and over, $6 per ton. No charge for packing or loading. Subject to change without notice.

The Beaumont (Tex.) Ice, Light and Refrigerating Co., July 1, quoted prices subject to change without notice: Car lots of 15 tons, $6 per ton; sacked for shipment by express, 75 c. per cwt.; 50 c. per 50 lbs; local, per 1,000 lbs., $5; per 100 lbs. 75 c.; 50 lbs. 50 c.; retail, 1 c. per lb.

Clark & Chaplin Ice Co., Portland, Me., season of 1891, quoted prices:

10 lbs. daily	$1.50 per month	10 lbs.	5 cents.
15 lbs. "	2.00 " "	25 lbs.	10 "
20 lbs. "	2.50 " "	50 lbs.	15 "
By the cake	20 c. per cwt.	100 lbs.	25 "

The Wyoming Ice Co., W. H. Ellis, Cheyenne, Wyo., quote as follows, season 1891: 13 lbs. daily (400 lbs. per month), $1 per month; 30 lbs. daily, $2 per month; 100 lb. lots, 25 c. per cwt.; 300 lb. lots, 20 c. per cwt.; 500 lbs. 15 c. per cwt.

The Carthage Ice and Cold Storage Co., Carthage, Mo., for the season quoted prices per month for weights named, delivered daily: 5 lbs., $1.50; 10 lbs., $2.75; 15 lbs., $4; 20 lbs., $5; 25 lbs., $6; 30 lbs., $7; 35 lbs., $8; 40 lbs., $9. Extra ice and irregular supply, *pro rata*. To butchers, saloons and other customers using 250 lbs. and upwards daily, 50 c. per cwt.

Wm. Jewell & Son, Bridgeton, N. J., make prices by the week, daily delivery, as follows: 8 lbs., 45 c.; 12 lbs., 58 c.; 16 lbs., 68 c.; 100 lbs. four deliveries, 50 c. per hundred; and the following rates per cwt.: Hotels and stores; 40 c.; butchers, poultry and ice cream, 35 c.

While in New York the machine ice has affected only the hotel, provision and meat trade of the natural ice companies, refrigerating machinery has undoubtedly cut down the price of ice. The ruling rate in July and August has been $2 per ton, but business has been done at as low a rate as $1.50; but this reduction is perhaps attributable more to the helter-skelter system of the dealers themselves than to the refrigerating or ice machine competition; for it is far from likely that the machine ice men in the city can afford to sell ice at $2 and make a reasonable profit.

The Refrigerator Ice Works, Jacksonville, Fla., for this season established their own delivery system, owing to various difficulties of detail; and in establishing their delivery adopted a coupon book system for the family trade; and stated in their circular that it was their desire that all their customers provide themselves with a book, as cash trade from the wagons would be at an advance in price over the book system. Below are given prices for both ways:

Pounds to Book.	Number of Coupons.	Pounds each Coupon.	Letter of Book.	Price of Book.	Price each Delivery.	Price same am't of ice cash from cart.
500	10	50	A	$2.50	25c.	30c.
520	13	40	B	2.75	21c.	25c.
500	20	25	C	3.00	15c.	20c.
500	25	20	D	3.25	13c.	15c.
500	50	10	E	3.75	7½c.	10c.
250	50	5	F	2.25	4½c.	5c.
500	5 10 20	50 25 10	G	2.75	Same as above.	
300	20	5	H	2.40	Same as above.	
125	9 8	5 10	I	1.00	Same as above.	

Unused coupons are redeemable.

Cards were furnished by the drivers, for patrons to fill out, thereby giving the main office each patron's name and address, so that in case of sickness or trouble with drivers the main office would know where or who the customers are.

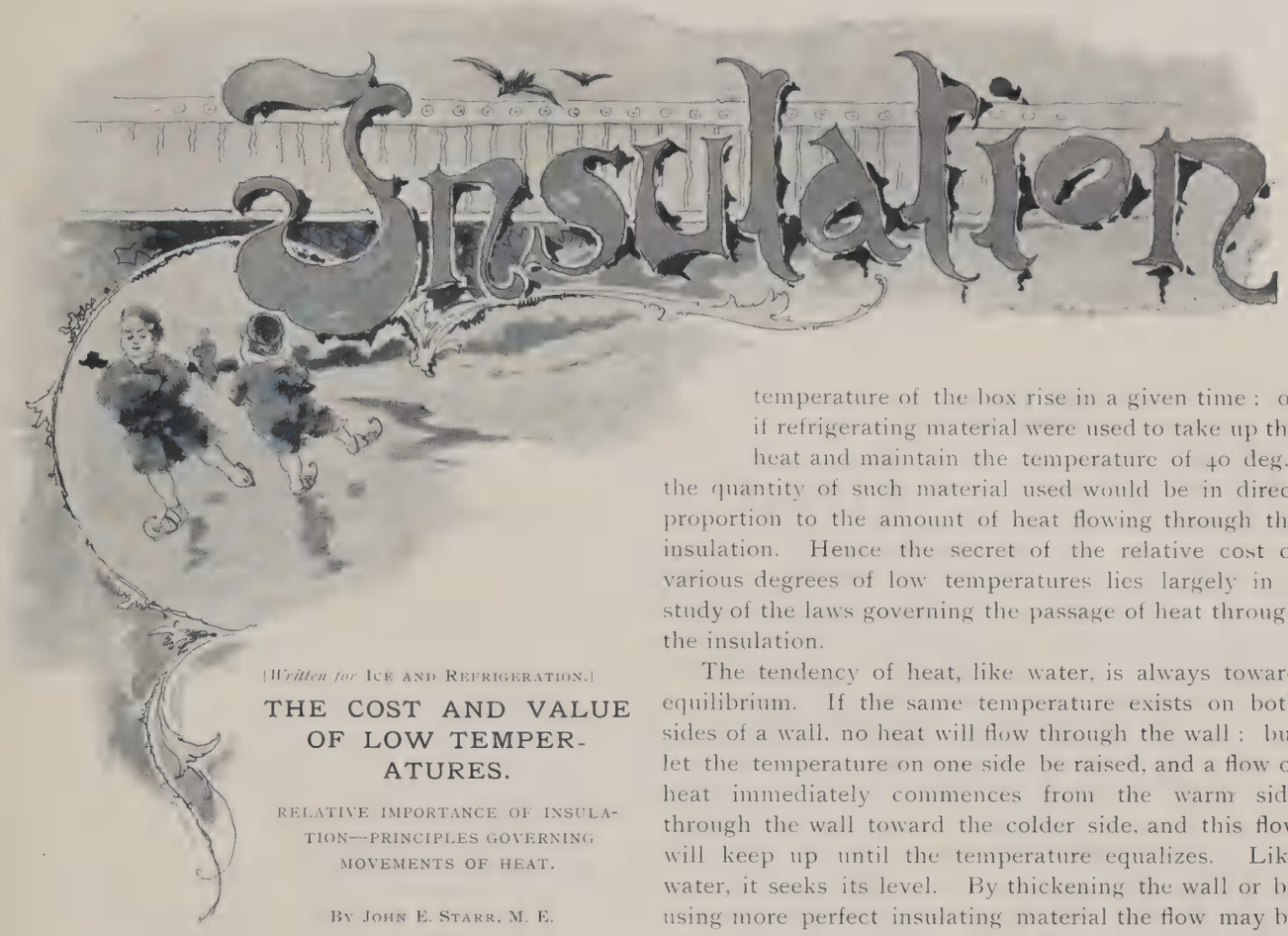
The Consumers' Ice Co., San Francisco, say: "Our price is $7 per ton in lots, and $10 for saloon lots, which is really too low, as coal costs $7 per ton. For the last twenty years and until this company started last year, ice had sold at $15@$20 per ton in large lots, and from 1½@3c. per pound in small lots. This coast would use a large quantity of ice in the hot valleys during the summer, but railroad transportation is so high as to nearly prohibit the use of it. In comparing the rates in the east with those here to over 100 places, we find that we are charged over ten times as much per ton per mile as the combination rates of your roads leading from the lakes to the interior. The towns along the shores of our rivers, sloughs and bays have competition in transportation, and freight rates permit the consumption of large quantities of ice, thus giving us an outlet for our product."

OUT OF SIGHT.



ICEMAN.—Shall I leave ice here this summer, Mum? I left it last summer.

MRS. PHLIGH.—Did you? Well, we did n't find it!



[*Written for* ICE AND REFRIGERATION.]

THE COST AND VALUE OF LOW TEMPERATURES.

RELATIVE IMPORTANCE OF INSULATION—PRINCIPLES GOVERNING MOVEMENTS OF HEAT.

By JOHN E. STARR, M. E.

What do low temperatures cost, and are they worth what they cost? is a question that should be asked by all who use refrigeration. The practical answer to this question in many individual cases is somewhat difficult, as numerous special conditions often have to be taken into account. However, a general inquiry into the subject and a fair understanding of some of the underlying principles governing the movements of heat, is of material assistance in arriving at conclusions of practical benefit to the user of refrigeration, whether the source of his cooling power be ice or machinery.

The refrigerating agent, aside from cooling material placed in the box and cooling air which is admitted by opening and closing of doors, has mainly to do with taking care of heat that finds its way through the walls of the refrigerator. The amount of ice or other refrigerating agent that is used for cooling material placed in the refrigerator, from a given maximum temperature to a given minimum temperature, is easily calculated if the quantity and specific heat of the material are known. The amount of refrigerating material used for cooling warm air admitted by opening and closing doors in a well managed refrigerator, is a very small item. The amount used to take care of the heat that flows through the insulation—which is generally the heaviest part of the work—is the important part of the problem in figuring refrigerative costs.

If a refrigerator be surrounded, say, by a temperature of 80 deg. and cooled to a temperature of, say, 40 deg., it is plain that if the doors were kept tightly closed the inside temperature would always remain at 40 deg. if heat did not get into the interior by forcing its way through the insulation or walls of the box; and that in proportion to the rate of ingress of the heat would the temperature of the box rise in a given time; or if refrigerating material were used to take up the heat and maintain the temperature of 40 deg., the quantity of such material used would be in direct proportion to the amount of heat flowing through the insulation. Hence the secret of the relative cost of various degrees of low temperatures lies largely in a study of the laws governing the passage of heat through the insulation.

The tendency of heat, like water, is always toward equilibrium. If the same temperature exists on both sides of a wall, no heat will flow through the wall; but let the temperature on one side be raised, and a flow of heat immediately commences from the warm side through the wall toward the colder side, and this flow will keep up until the temperature equalizes. Like water, it seeks its level. By thickening the wall or by using more perfect insulating material the flow may be retarded, but no matter how thick the wall or how perfect the insulating material, there will always be some flow as long as different temperatures exist on each side. On the same insulation the rate of the flow will always be in nearly direct proportion to the difference of temperatures. The thermometers indicating the temperatures on each side of the insulation may therefore be said to be the pressure gauges indicating the force that is driving the heat through the insulation.

If we look at a steam pressure gauge and see that the pressure is twenty pounds above the atmosphere, and find that when we open the steam valve the steam will flow out at a certain rate, we know that if we raise the steam pressure to forty pounds, about twice the amount of steam will be forced through the opening. So if we have a temperature of zero on one side of a partition and a temperature of twenty above on the other side, we find that a certain amount of heat will flow through from the warmer to the colder side in a given time; we know that if we raise the warmer temperature to forty degrees, about twice as much heat will pass in the same time through the same area of such partition.

Every degree of rise of outside temperature, if the temperature inside the refrigerator is held constant, or every degree that the inside temperature is lowered, if the outside temperature remains constant, means greater use of refrigerating material, *ergo*, greater expenditure of money, provided always that the insulation remains the same and the conditions as to opening and closing of doors and amounts and temperatures of the material to be cooled are the same.

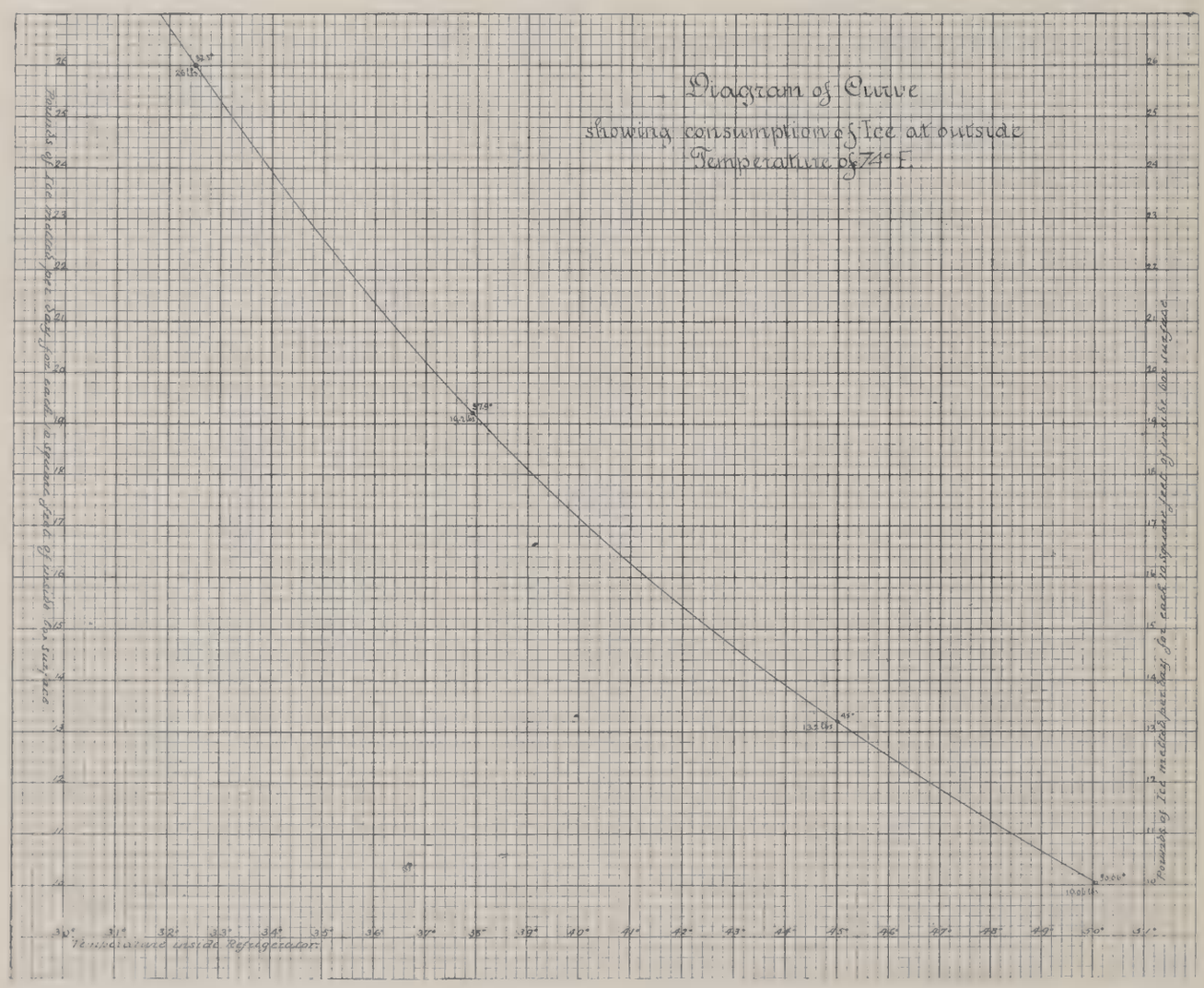
To reduce these generalities to a concrete and tangible form, a practical test, made by the writer, of the cost of different degrees of refrigerative temperatures may be cited. Two refrigerators of exactly the same size and

construction were used in making the test, and in order to check the results, one box was refrigerated with ice and the other with anhydrous ammonia. The temperature surrounding the boxes was kept constant at 74 deg.

Both boxes were run for twenty-four hours at a constant inside temperature of 50 deg. F., and then for similar periods of time at several other temperatures down to 32 deg. F. Careful records were kept of the amounts of both ice and ammonia used. The fact that the amounts used of each of these refrigerating agents was in the same proportion throughout was a sufficient guarantee of the reliability of the tests as a basis of calculation.

The amount of refrigerating material used was of course compared to square feet of wall surface exposed to 50 deg., the difference between inside and outside temperatures was 24 deg. This 24 deg. of difference represents the pressure, or head, tending to drive the heat through the insulation. As this "pressure" increases, the amount of heat transferred increases *in a more rapid ratio* than the increase of "pressure," for it will be noticed that the curve of the ice consumption rises more sharply as the inside temperature decreases. Hence the amount of ice consumption between 50 deg. and 40 deg. is greater *per degree of difference* than between 50 deg. and 74 deg.; and between 40 deg. and 32 deg. greater per degree than between 50 deg. and 40 deg.

This rate of increase of heat passed for each degree of difference as the total difference of temperatures in-



by the boxes; that is to say, the area of the four sides, top and bottom.

To maintain the ice box at an average temperature 50 deg. F, each ten square feet of surface required a meltage of ten lbs. of ice per day; at 45 F., 13.2 lbs.; at 37.9 F., 19.2 lbs.; and at 32.5 F., 26 lbs. The outside temperature in each case being 74 F.

These tests, when platted and connected as shown in the accompanying diagram, show a regular curve, enabling us to read the ice consumption per day per ten square feet of box surface exposed to the outside temperature for each degree of inside temperature from 50 to 32.

It will be borne in mind that the outside temperature was 74 deg., and that in lowering the inside temperature creases, follows well established laws, but their exposition would take up considerable space, and is hardly necessary for the purposes of this article, as the curve in the diagram indicates in a general way what this increase amounts to.

The boxes used in these tests were ordinary family refrigerators, and the insulation was, comparatively speaking, very poor. A box that uses one pound of ice per square foot per day to maintain a difference of only 24 deg. between inside and outside temperatures is, of course, a very expensive box, no matter how little may have been paid for it. But it must be remembered that even had these boxes been well insulated, and used but a quarter of a pound of ice per day per square foot, at a difference of 24 deg., they would have used *propor-*

tionally more at greater differences. Temperature costs money—there is no escape from the inexorable laws governing the transmission of heat. We can reduce the cost to a minimum by good insulation and good circulation, but try as we may, it will cost more to run the same box at 40 than at 50, unless we improve the insulation or the circulation, or both.

Good insulation, then, is of paramount importance: it is paid for but once, while ice is paid for every day. An extra dollar spent on good insulation may mean ten dollars saved in refrigerating bills in the course of a couple of seasons. If your box is poorly insulated, and will only maintain a temperature of 50 on a certain ice consumption, do not hesitate to spend money to improve the insulation, for you will surely obtain a *lower temperature with the same ice cost, or the same temperature at less ice cost.* After you have gotten a good box, remember that lower temperatures will cost more money, but remember also that up to a certain limit the lower temperatures are worth many times their cost.

The butcher can well afford to buy 20 or 30 per cent more ice if by so doing he can lower his temperatures from 48 deg. or 50 deg. to 36 deg. or 38 deg., and thereby properly cool and keep his meats, and save many times his ice cost in keeping hundreds of pounds away from the dump or the sausage man. The restaurant keeper or hotel man, with the uncertain and capricious demand for his perishable wares, can save his ice bill over and over again by having sufficiently low temperatures.

So on all along the line, it will be found that while temperature costs money, the investment is not only one that repays the principal, but carries with it a handsome percentage of profit.

Keep records of the ice consumption in that ice box, and of the inside and outside temperature for ten or fifteen days, then improve the insulation and keep the same records for a like period, refer the ice consumption to the average difference of temperature maintained, and then it will plainly appear that one way to make money is to save money.

UNFULFILLED PROPHECY.

Late in April last a gentleman well known in ice circles at Kankakee and Chicago was interviewed by the ubiquitous reporter, who made the Kankakeeian say: "If my years of experience in the ice business count for anything, I think that there will be a great panic in the ice trade this summer." And having told how many great ice houses in Illinois and Indiana were then empty, and how "freights would eat up the profits on ice brought from the lakes of Wisconsin," he frightened the reporter and the public out of a month's growth by adding: "Prof. Hicks, of St. Louis, who has never failed in his predictions for ice men, says that we are going to have a terribly hot summer. That means that the supply of ice on hand will dwindle away before the end of May, and then will begin the ice famine; for, of course, the machine ice makers can't begin to supply the city of Chicago alone."

No doubt, the Kankakeeian's intentions were "strictly honorable"; yet the experience of the summer, with its weeks of cool weather, when the mercury hugged the 60's, whereas it ought to have been parading up and down between the 85 to 95 notches, but impresses one with the old advice (paraphrased): "Put not thy trust in weather prophets," whose April specialty is July and August weather for the ice men! For this once, at least, Prof. Hicks is "off" in his prophecy, and the panic is still a thing of the distant future. Barring these minor discrepancies, Prof. Hicks' prediction and the Kankakeeian's faith therein—in May—are interesting facts—in September.

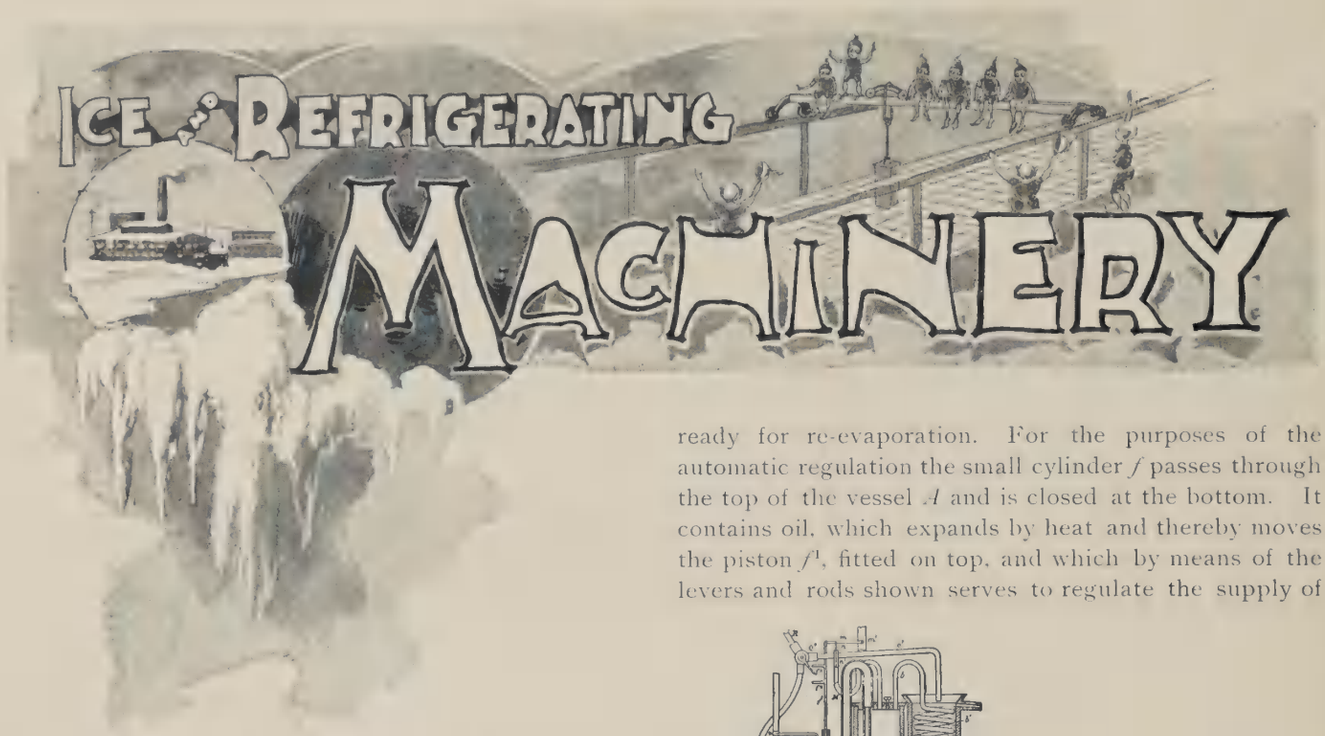
Just how interesting, every reader will decide for himself; because we apprehend that most ice dealers had just enough chilly weather in July to appreciate *un bon mot* like the above prophecy, if they have since recovered their latent good humor under the more sunny skies of August. But, if we were going to "formulate public opinion" on this topic in Ice and Refrigeration, it would be difficult to put it better than did Capt. J. E. Lombard, of Portland, Ore., to a reporter along about the first of August, when a few hot days had induced the managing editor to "do" the ice business for a change. The reporter asked the captain, "How is the ice crop going to hold out this hot weather?" to which he replied: "It is scarcely touched as yet. Some people have an idea that there is a fortune in the ice business, but it is a great mistake. The present season has been an unusually severe one on ice dealers. May was cold and June rainy. Now they have two months only to get their revenue for the year's expenses. Another thing not generally taken into consideration is the waste of ice by melting in delivery. I well remember when I used to take my wagon out into South Portland. Some would want five pounds, some ten, and once in a while one fifteen; and it's a fact, that in making that long trip I would lose more ice by melting than I would get paid for. No, there isn't any danger of an ice famine, but you can't expect the retailers to lower the prices. They will be lucky if they make expenses this year."

And now the newspapers of Atlanta, Ga., are roasting the ice companies for charging "extortionate prices"—one cent a pound, which, ye editors think, is too, too much. As a "clincher," they cite prices of their neighbor, Macon, where ice brings twenty-five cents per hundredweight, and where a big local row is on hand with a neighboring town, the ice companies of both of which towns will, perhaps, before they cool down, be giving away their ice and throwing in decorated ice chests for their customers, or to such as will kindly assist them in working all season without a profit.

In deciding the other day that an ice man might travel on the same street with a north side grip car Justice Kersten laid down the broad principle that the cable company does not own the whole street. This, however, is mostly one of those legal fictions that you read about. —*Chicago Paper.*

At any rate, it would seem to be a concession in favor of the "ice man" as refreshing as unexpected at this season of the year!

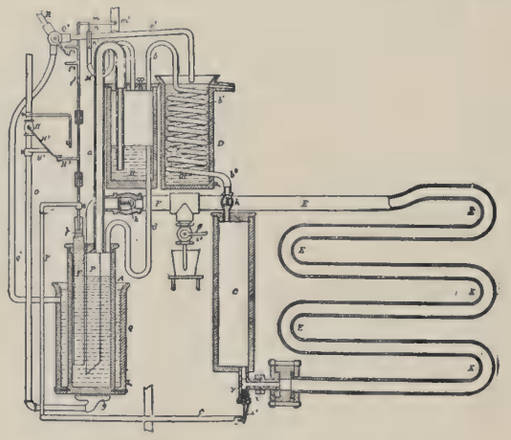
At a dancing party at Albuquerque, N. M., there was a display of large cakes of ice from the Crystal Ice Co., in which incandescent lights were frozen, illuminating the pure ice cakes, and also in which roses and bouquets of roses were frozen, which were greatly admired and did much toward cooling off the dancing departments.



REFRIGERATING APPARATUS.

R. A. Messervey, Halifax, Nova Scotia, has brought out a refrigerating apparatus in which a saline liquid of low temperature is made to circulate. The patentee causes the pipes containing the liquid, where they pass through the space in which refrigeration is to take place, to be inclosed within a metal casing filled with blocks of rock salt or conducting material, the object being the purification of the cooled air, which leaves its impurities behind with the vapor deposited and condensed on the enlarged refrigerating surface.

The letters *A* and *B* indicate two strong vessels placed at different levels and containing liquid ammonia. The pipe *a* leads from the top of the lower vessel *A* to the top of *B*, and is continued to nearly the bottom of the latter vessel. The trapped overflow pipe *d* leads back from the level of liquid in *B* to the top of *A*. From the top of *B* the pipe *b* leads to the worm b^1 in the cooling vessel *D*, and is continued to the top of cylinder *C* through the check valve *h*, which prevents the return of gas. The freezing coil *E* communicates with the bottom of *C* through the pipe *i* and valve i^1, which latter is moved automatically to open and close the communication as required. The other end of the freezing coil *E* is jointed through *F* to the top of and reaches down into the vessel *A*, and is also fitted with a back pressure valve *K* to prevent gas returning into it. The operations are carried on as follows, viz.: *A* and *B* having been charged with liquid ammonia as indicated, the vessel *A* is heated, which may be done by means of gas as at g^1. The vapors rise into *B*, any moisture carried over being returned through the trapped pipe *d*, while the gas passes on and is liquefied under pressure in the coil b^1 and cylinder *C*. When the vessel *A* has been nearly depleted the flame is automatically removed, or extinguished, and the vessel cooled. At the same time the valve i^1 at the bottom of *C* is gradually opened and the liquefied ammonia allowed to escape into the coil *E*, where it evaporates and causes great reduction of temperature, while itself returning through the pipe *F* to the cylinder *A*, and being absorbed by the liquid therein ready for re-evaporation. For the purposes of the automatic regulation the small cylinder *f* passes through the top of the vessel *A* and is closed at the bottom. It contains oil, which expands by heat and thereby moves the piston f^1, fitted on top, and which by means of the levers and rods shown serves to regulate the supply of



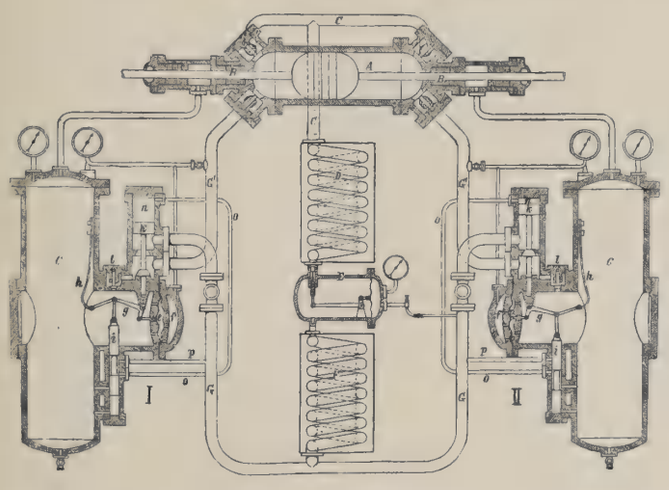
gas through the pipes *G*, and that of the cooling water through pipes *Q*, at the same time actuating the release valve i^1 at the proper intervals. The parts marked *m*, *n*, *t*, and others are provided for aiding in starting the apparatus.

GAS ESCAPING FROM STUFFING BOXES.

In order to utilize the gases escaping from stuffing boxes of refrigerating compressors, H. Nehrlich, according to German patent No. 51,009, proceeds as follows: The escaping gases are collected in a closed vessel of constant volume, and returned therefrom into the suction pipes of the machine, in such a manner that at a certain pressure in said collecting vessel, by means of a valve operated by a lever, the suction pipes are shut off from the vaporizer, and connected with the collecting vessel; but when the collecting vessel has been emptied, the same will be shut off, by means of an identical device, and the suction pipes connected with the vaporizer.

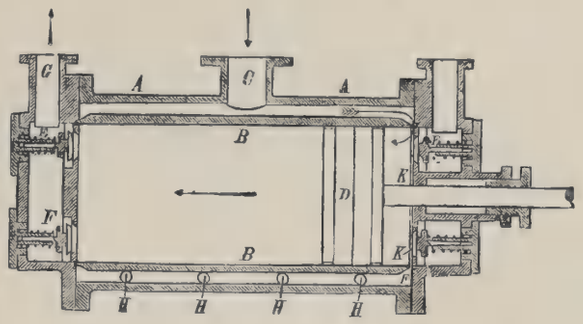
The device for receiving and returning the gases escaping from the main stuffing box *B*, of the compressor *A*, is represented twice in the drawing. *C* is the main pressure pipe; *D*, the condenser; *E*, the regulating valve; *F*, the vaporizer; and *GG'*, are the main suction pipes. In the space *f*, there is the diaphragm *e* outside, worked upon by a constant pressure of gas, and also by the spring *h*, by means of the lever arrangement *G*, in the position as represented in *I*, and in the same way as by the pressure of gas in *f*. As long as the escaping gases gradually accumulating in *e*, have not reached the tension

required, the diaphragm and all the elements remain in the position as shown at *I*, in which condition the sliding valve *i*, keeps the space *n*, above the piston valve *k*, on its way from *o* to *p*, in communication with *G*, thus the pressure of vaporization being above the piston *k*. The same pressure is exerted from below upon the piston, and the valve *k* remains opened by its own weight. In the position of the valve *k*, as shown at *I*, therefore the main suction pipes are not out of communication, *i. e.*, the machine is in normal operation. But when the gases collected in the vessel *c*, at last reach a tension greater than the pressure spring *h* is exerting, they will push the diaphragm *e* outside, the spring *h* co-operating. Thus the diaphragm *e*, lever device *g*, and sliding valve *i*, taking the position, as shown at *II*, the amount of gas in *n* will be emptied into the vessel *c*, and the piston will be raised by the pressure of the vaporizer still acting below the same, whereby the conical valve attached thereto will take the position as shown at *II*. Now the main suction pipes being out of communication with the compressor, the compressor is compelled to draw through the suction valve *l*, out of the vessel *c*, instead out of the vaporizer. By means of a few strokes the compressor conducts the gases, so far as desired, out of *n*, back into the circulation of the machine. The pressure in *c* being thereby reduced, the diaphragm inside relieves the pressure in *f*, and pushes the diaphragm toward the inside. The valve *i*, and the other elements, thereby will occupy again the position as shown at *I*, in which they will remain until new accumulations of gas in *G* cause a repetition of the proceedings described.



DOUBLE ACTING COMPRESSOR AND VACUUM PUMP.

This device, which is the subject of the accompanying sketch, is the subject of a German patent granted to Mr. Rudloff (No. 47,790). The movable cylinder *B* inside of the exterior cylinder *A*, constitutes the double-acting valve of the pump, the seat of which to be found alternately on one or the other corner of the cylinder. The walls of said cylinder form an annular space into which the opening of a branch socket *C* enters, the steel balls *H* in said annular space serving as guides. When the cylinder *B* is operated upon by the piston *D* of the pump, in the direction of the arrow, the right end of the interior cylinder acting as a valve, will leave its seat on the right hand corner of the cylinder *A*, and gas escaping out of the annular space and the annular groove *K* formed in the cover, will follow the piston *D*; while the gas having by the preceding stroke of the piston *D* entered into the suction valve *B*, will leave the pump through the opened pressure valve *F* in the left hand cover and pass through exhaust sockets, the pressure valves *F* of the right hand cover being closed. On a reverse motion of the piston, the action of the valves is reversed correspondingly.

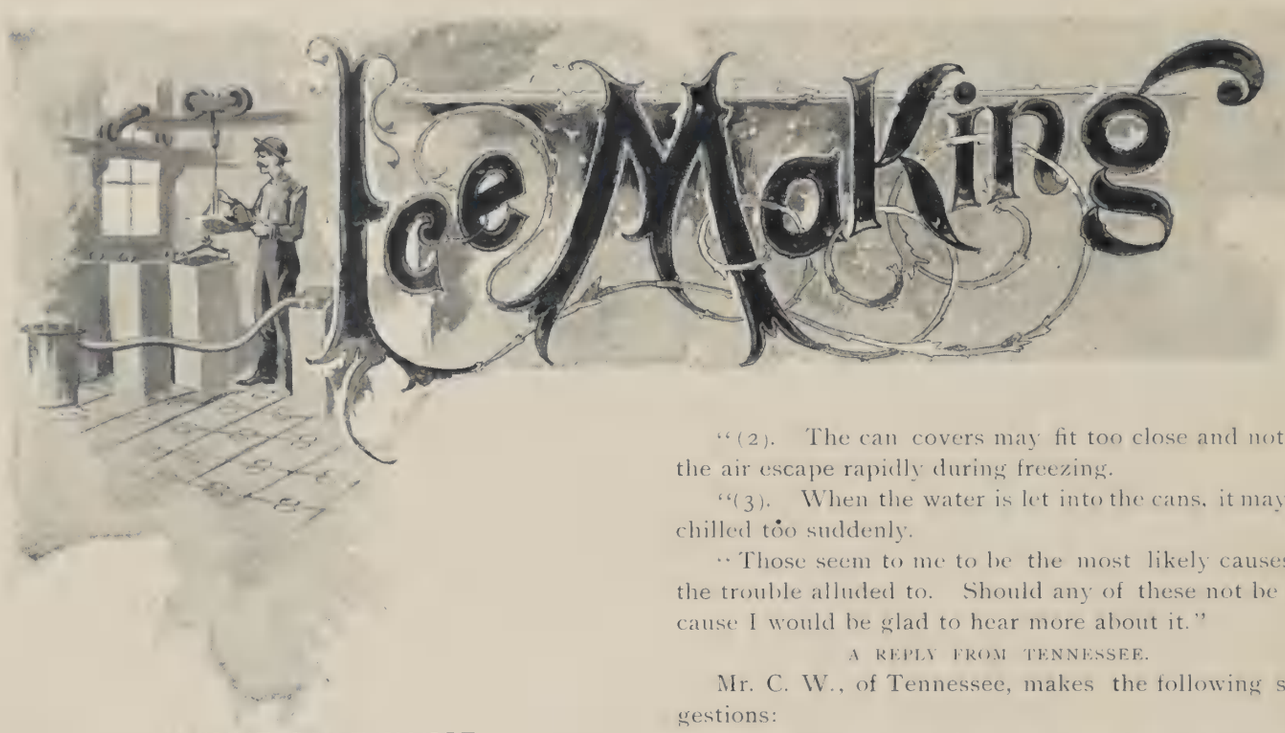


ENGINEERS NEEDED.

The rapid increase of refrigerating machinery has created a demand for engineers who are trained to handle this special class of machinery, and the number of such engineers is not by any means in excess of the demand for their services. Rather the supply of thoroughly competent men is really under the demand than in excess of it; and the field is one which offers to ambitious stationary engineers many opportunities. Indeed, the *Stationary Engineer*, in a recent issue, puts it even stronger, holding that the engineer who wishes "to keep up with the procession" must become familiar with the operation of refrigerating machinery. All steam plants will not, of course, include refrigerating apparatus, any more than they now include electric machinery, but the time has come when the engineer who is without a practical knowledge of electric light machinery finds himself more or less handicapped on account of his lack of experience in handling electric machines; and so it will soon be in regard to the handling of refrigerating machinery.

"The time is not far distant," says that journal, "when mechanical refrigerating machinery will be applied to the cooling of hotels and dwellings in summer in a manner similar to that by which the heating is now done in winter, and a portion of the heating apparatus will be used for this purpose, for there is nothing inconsistent in the use of the ordinary steam radiator for the cooling of rooms if the radiator is supplied with air or gas at a low temperature. Trifling changes only would be required to adapt the steam heating system to such use."

The engineer, therefore, who wishes to advance will make an extra effort to comprehend the principles and become familiar with the practice of all kinds of machines which he sees are coming into use, or that are being placed in charge of the engineer. The mechanical refrigerating machine is one that requires his immediate attention, as within the next few years he is sure to find that such knowledge acquired now will have greatly benefited him socially and financially, while he who neglects his chances now will have plenty of opportunities in the near future for regetting not having informed himself on this subject.



WHITE CONE IN ICE.

AN IMPORTANT QUESTION PROPOUNDED—HOW TO AVOID WHITE CONE—VIEWS OF SOME PROMINENT PRACTICAL ICE MANUFACTURERS.

To the Editor of ICE AND REFRIGERATION:

Can you inform us of the most effective way of getting rid of the white cone which forms in the bottom of cakes of ice while in process of freezing? We boil our water to a great degree; our distilling apparatus is perfectly air tight, and yet there seems to be sufficient quantity of air absorbed by the distilled water to form a white cone in bottom of the blocks of ice.

We observe other factories making ice perfectly clear and transparent on bottom of cakes, and have been at a loss to know why we cannot do the same. We have insulated the bottom of our cans and improved our ice to a marked degree in the respect referred to above, but have not been able to overcome the trouble entirely. L. E. B.

As ice manufacturers will understand, this is quite an important query, and one which has occurred to many practical men, who would answer it in nearly as many different ways. Appreciating the importance of the problem, the editor of ICE AND REFRIGERATION therefore submitted the query to four gentlemen whom he knew to be men of large experience in ice making, and likely to have met the difficulty in their own practice, whose suggestions are given below, and to whom the editor returns thanks for their prompt and valued replies. The subject is not exhausted, however, by any means; and ICE AND REFRIGERATION would be glad to devote space for its further discussion by our readers, who are cordially invited to contribute their views on the subject. The white cone is so common in manufactured ice, and so objectionable on the score of the appearance of the ice, if for no other reason, that the publication of a successful remedy will be of the highest value to the trade, and such remedy a full discussion of the topic will undoubtedly develop.

A REPLY FROM GEORGIA.

Mr. A. R. E., of Georgia, says:

"I can suggest two or three reasons why the ice in question may have the white cones:

"(1). It may be that the distilled water is not used soon enough after condensation, but is allowed to stand, and 'absorb air.'

"(2). The can covers may fit too close and not let the air escape rapidly during freezing.

"(3). When the water is let into the cans, it may be chilled too suddenly.

"Those seem to me to be the most likely causes of the trouble alluded to. Should any of these not be the cause I would be glad to hear more about it."

A REPLY FROM TENNESSEE.

Mr. C. W., of Tennessee, makes the following suggestions:

"I do not think that the white cone in the center of ice frozen in cans can be gotten rid of entirely. If ice is frozen on plates or around coils, you avoid the white in the ice if the machine is properly handled. Ice can be frozen nearly without the white cone if the distilling apparatus is properly made and very carefully managed and the ice not frozen at too low a temperature.

"I would advise care not to fill the cans too quickly, which causes the pipes leading from the distilling apparatus to the tank to get empty, by which some air will get into the pipes, and from there into the cans. A very careful engineer can manage this, provided the factory has a good distilling apparatus, and a good ice machine."

A REPLY FROM ALABAMA.

Mr. J. R. W., of Alabama, offers the following suggestions:

"The gentleman inquiring should give the kind of apparatus used in distilling, and a full description of the water tanks; whether live or exhaust steam is used; the character of the water has a great deal to do with it. The trifle of air absorbed does no harm after water is cooled. In some places air coming in contact with distilled water, while hot, produces a red or yellow coloring.

"What this 'cone' is, is still an unsolved question. If it is air, as we understand air, why are the cones so discolored at times? Why is it not observable to a degree throughout the block, and from the side inward, as from the bottom upward.

"We know that in freezing blocks, the sides and bottom progress with the same rapidity. In the first stages, it resembles a wide-spread letter 'U.' If you arrange a reflector so as to throw light into the mold and observe the progress of freezing, you will find the cone forming on the bottom after from one-quarter to one-half an inch of ice has been formed. The tubes, or cells, nest together. There are none shown on the sides. As ice forms you find these cells are deflected from perpendicular to an angle, caused by the side crystallization crowding against the formation of the cone. The freezing continues until the block is solid. Every portion of the

block is as clear as glass except the pyramid of cone three or four inches high. Why are there no tubes or cells from the sides?

"When we fill a mold with hydrant or spring water (which has air in it, we know,) and freeze it, we find sides, bottom and top all the same—the *air* makes the whole block white. We find at the top of many blocks proof of air being absorbed while the water is being frozen. This only occurs when machines are shut down for two or three days. Does not the condition of the block you observed freezing suggest the question, does air separate from water and *sink* as the water is *chilled?* And does not the block frozen from the hydrant water answer it in the *negative?*

"What is this cone? Has it been analyzed by chemists? Yes; but not in a way to reach the true result. It is not the fault of the chemist, however. The water of melted cones has been furnished for examination. Now, melting in an open vessel of a cone has set free the very thing that causes the trouble and should be analyzed; *i. e.*, the vapor, or gas, that was confined in the tubes, or cells, of the cone. It is a result of chemical change in the decomposition of water by heat and the subsequent condensation of the vapor. This is all we know as yet. The water for test should be procured from the bottom of a block while being frozen; should be syphoned into the bottle, and the bottle tightly corked and sealed, then the chemist should be directed to test this *gas* as well as the water.

"Theories have not rid us of our greatest trouble. Patented apparatus seems of little use. Results obtained in places cannot be reached in others. Machines, side by side, one with the latest apparatus and one without, and no better results obtained with the one than with the other. So far, a very free exhaust from the steam condenser, and a good filter have been found to remedy the difficulty in a great measure, but not to remove it entirely.

"To sum up briefly, I would say:

"To prevent cone in ice requires clean boilers. The steam pressure should be ninety pounds or over. *A very free flow of steam from the exhaust of the steam condenser* is the principal remedy. A waste here is a saving in quality of the ice. Filter the distilled water through animal or sugar tree charcoal. Do not permit water to be drawn too low in the reservoir. Absorbed air does not cause cone. Air shows up in the side or body of the blocks. To give more detailed directions a full description of the kind of apparatus used, whether steam is taken direct from the boilers or through an engine, etc., should be furnished."

A REPLY FROM TEXAS.

Mr. F. M. P., Texas, says:

It is a difficult matter to arrive at the cause of your opaque ice when you state plainly that the distilling apparatus is in perfect order. With that fact a certainty, you must look to the method of handling your freezing tank. The filling of molds must be done with great regularity; also should the number of cans filled per hour be so great a drain on the apparatus as to partially empty the cooling coils or receiver, a vacuum is created that will draw air in from the outside, and damage your water.

Many distilled water cooling coils are fitted with a steam connection direct from the boiler, the "bleeder," which forces steam in with the distilled water, but is not boiled and de-aerated before passing into the service. Naturally, when this additional supply is utilized, the ice will be whiter than at other times.

Use a can filler with check automatic valve on extreme end, and not some distance up the pipe next to the hose connection, or point of service. Patent ones are fitted correctly in this respect. The reason is obvious: When the water passes out into the can it carries the pipe full of air down with it. Opinions differ as to the proper depth of freezing tank and amount of clearance of cans in position from the bottom: if they come too close, the temperature being colder at the bottom of the brine, the ice will freeze rapidly at the lower end, which will make the ice whiter than the balance of the cake. Should the trouble continue and all effort to remedy prove unavailing, adopt a few last resort measures; but for my part, I dislike to yield to refractory apparatus.

Draw out the last five gallons of water with a small hand pump from the partly frozen cake, and refill with fresh distilled water. Another practice is to lift each lid once or twice during the progress of freezing, and gently agitate the water with a stick.

Without knowing the make and character of the machine, and a complete description of the method of treating the distilled water in transit, it is very hard to attempt to locate the evil.

PROTECTION FOR EYES AND LUNGS.

To enable operators of refrigerating machinery to meet in time any leakages or breakages, and to enter rooms filled strongly with escaping ammonia, sulphurous or carbonic acid gas, the use of eye protectors and respirators is to be recommended. The principle of the respirator consists in procuring the air for breathing from outside. To this end the apparatus illustrated in the accompanying figure is fastened before the mouth, and the air necessary for breathing drawn in from outside, by means of a hose. In the accompanying sketch *1* is a valve case provided with especial protectives to prevent the inhaling of noxious gases. *2* is an elastic respirating hose combined with said valve case. *3* is a device for purifying the air to be inhaled, and is connected with a removable strap; and *5* is a spiral hose for admitting air. There is also shown in the drawing an eye protector, which encloses the eyes hermetically by means of rubber rings, preventing corroding vapors from entering into the eyes, as well as a clamp to prevent inhalation through the nose.



A PENNSYLVANIA barber says he gets along with half the quantity of ice he used last year by remodeling his water cooler in this way: "He places in the bottom of his cooler a round tin stand, in which small holes are punched, and which rests on three legs about an inch long. This keeps the ice off the bottom of the cooler, and makes it partly project above the surface of the water. He says that the ice keeps longer and is a saving of money to him at the end of the season."

[*Written for* ICE AND REFRIGERATION.

THE SITUATION IN THE SOUTH.

EXCESSIVE BUILDING OF ICE FACTORIES AND REDUCTION OF PROFITS—THE POLICY OF THE BREWERS AND ITS EFFECT ON THE ICE TRADE.



EARLY all will agree that the ice season of 1890 has had most unfortunate results. The previous winter was an open one, and very little ice was harvested in the North. As a consequence, the supply in that section was not equal to the demand and a rise in the price followed. This and the erection of ice machines in several of the larger cities of the North, furnished ample food for discussion by the newspapers of the country, and as is usually the case when matters of any kind are discussed by those who have had no experience therein, a large amount of misinformation was scattered abroad. People who were waiting for a good thing thought it was in sight, and began to investigate, and naturally the first ones they would meet would be the promoters and manufacturers of ice machines. Now it is reasonably safe to say that in an industry of such recent development as the manufacture of ice for commercial purposes, the inquirer after the facts in the case would be at a very decided disadvantage if he relied entirely upon those who have machines to sell. Hence purchasers in their dealing are regaled with all sorts of fairy tales.

They are told that ice can be made at a nominal cost. Figures are shown them, based on the full output of the machine, no mention probably being made of the fact that no machine, the capacity of which is based upon the maximum demand of its locality, can dispose of that capacity for more than ninety days in a year. They are not informed that the farther south one goes the less the consumption is *per capita*, nor are they advised as to the size the machine should be for the place in which it is to be erected. No intimation is given them that ammonia wastes and must be replaced. There is no wear and tear, everything runs smoothly, and he who owns an ice machine will have almost nothing to do but to count his profits, and what little time remains will be passed in perfect peace.

The bait is swallowed, the machine is erected, and then the process of disillusionizing begins. Expenses never dreamed of begin to creep up, troubles of all kinds arise, break downs occur, the machine gets "out of whack" generally, and the bed of roses, which was so vividly pictured to the investor, turns out to be one of thorns instead. Owners of new machines find that they have miscalculated the demand for their product, and in their endeavors to save themselves begin to push its sales at prices which leave little or no margin, with the result principally of demoralizing the trade.

The fact that the daily manufacturing capacity of the territory formerly dependent upon this place (Birmingham, Ala.) for its supply, has been increased about 150 tons, with very slight, if any, increase in the demand, will illustrate the extent to which this indiscriminate building has gone.

In this place, during the summer months of 1890, the average daily consumption was sixty-five tons; capacity, ninety-five tons. To-day the consumption is practically the same and the capacity is 125 tons. At one point near this place, one machine furnished ample ice last year to meet the demand. Another one was erected this year, and the old one is financially embarrassed. At another point, last year, a 5-ton machine was of more than sufficient capacity for the trade. Now that other parties have erected an additional plant of ten tons capacity, when there was no increased demand, is it a wonder that the owners are largely engaged in trying to discover where the profits are coming in?

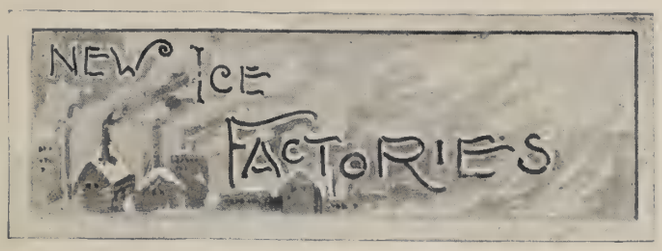
Other instances could be cited, but these are enough to call attention to the demoralization of the trade, which it will take years to overcome, and which has been largely brought about by the methods adopted by the machine men in their efforts to sell their machines. These methods, unless discarded, are certain at no distant day to place them in the same category with the patent churn men and others of that ilk, who used to travel over the country fleecing the ignorant and unwary.

Another serious matter for consideration, is the position of the brewers with reference to the ice trade. All brewers require refrigerating machines. All retailers of their product require ice. The addition of an ice machine does not involve a comparatively large outlay, while the cost of production of ice is reduced to a minimum, from the fact that little or no extra help is required in addition to that employed in running the refrigerating machinery. As a result, some brewers (and the movement is likely to become general), are now furnishing ice to their customers at cost, or a slight advance thereon, as an inducement to buy their product. This plan, if generally adopted, will be a very serious blow to the trade, and this, together with the uncertainty as to how soon the brewers will reach out after the general trade, renders the outlook for the southern ice industry far from cheerful.

In conclusion, the writer would say that he has not one dollar's interest in any ice machine in existence. Some two and one-half years ago he was appointed by the United States court receiver of an ice manufacturing company, which was in embarrassed circumstances. In the management of that property he would at times think that he was having more trouble with his machine than any one else could possibly have; and on learning that others were undergoing the same experience, on the principle that "misery likes company," he would feel immensely refreshed thereby; and the result of his experience and observation then has led him to believe that the saying, that "life is full of tribulations," was meant solely for the manager of an ice factory. He also surmises that the ranks of those who consider life "a delusion and a snare," will soon receive a not inconsiderable addition from among those who have invested in the ice industry during the boom of the last twelve months, and are now waiting for returns.

O. W. C.

THE Columbus (Neb.) packing house and adjoining buildings, with their contents, were burned August 23d; loss, $10,000; no insurance.



The month of August was a very good one for ice factories all over the country, and in spite of the fact that it is almost a year before another season, the number of new companies forming, both north and south, is quite large. A considerable number of enlargements are also announced to be made during the coming winter. The newspapers of the country, both metropolitan and inland, have devoted considerable space of late to manufactured ice, and have done much to call public attention to it, the comments being universally favorable to the "new ice." Many of the statements and predictions are extravagant almost to the extreme, but while, therefore, unfair to the natural ice trade in general, are not however likely to do any great damage either way; although in many places, if the advice of the local press were followed—"Go into it!"—the results would hardly warrant the extravagance of the writers' "certain evidence that it would pay."

ALABAMA.

Marion—The Standard Ice Co., of Salem, has just completed a spacious ice house.

ARKANSAS.

Arkansas City—A proposition for the erection of an ice factory and cold storage plant will be made to the Board of Trade. Marks & Davis can give information.

Fort Smith—The Border City Ice and Coal Co. has just closed a contract for a 50-ton machine to be put in this fall and winter, making their capacity between sixty-five and seventy tons daily. They will also put in cold storage for next season.

Pine Bluff—A 10-ton ice factory is to be established with capital of $40,000, one-fourth of which has been taken in the city at $25 per share. It is said the whole amount has been subscribed. Ice will be furnished to saloons, hotels and other large consumers at forty cents per 100 pounds, and to private residences at fifty cents per 100 pounds. A guaranty is to be made by the purchasers that they will stick with the new company for one year. In return the capitalist will give bond that he will not sell out to any rival corporation for three years.

CALIFORNIA.

Fresno—The National Ice Co. has been incorporated by Wm. T. Jungbluth, John A. Buck, S. H. Simonds, E. L. Jungbluth and A. F. Morrison; capital, $250,000.

Hamptonville—A company has been formed at Fresno to build a new town called Hamptonville, on the San Juaquin river, near Fresno, who, among other projects, propose to erect an ice factory.

San Bernardino—I. H. Bryson and others, of Los Angeles, will erect a $60,000 ice factory. Warm creek will be carried to the factory in a flume, developing 50-horse power. Artesian wells will be sunk to obtain water for ice making. The enterprise will be pushed right along now.

COLORADO.

Colorado Springs—The factory of Colorado Springs Crystal Ice and Cold Storage Co., Civill & White, Proprs., has begun making ice, using a Blymyer machine. The cold storage house has twelve rooms, each 9×12 feet, which will be rented to commission houses and markets. The company has also stables for twelve horses.

Pueblo—The Union Ice Co., of Colorado Springs, has established an ice factory to supply both cities. Ice was first received from Pueblo at Colorado Springs August 10.

FLORIDA.

Gainesville—The ice factory has resumed operations.

Key West—Chicago capitalists are building an ice factory.

Key West—J. R. Scott, of Waukegan, Ill., is reported as to establish an ice factory at Key West.

Palatka—The ice factory is running at full capacity of ten tons daily.

Pensacola—The Stratton Ice Works will enlarge their plant at once, at a cost of several thousand dollars. Mr. J. R. Kellar is resident manager.

Titusville—The Atlantic Coast Ice, Fish and Canning Co. will erect an ice factory.

GEORGIA.

Augusta—The Augusta Ice Co. will enlarge its plant, increasing its capacity from twenty-two to thirty-seven tons per day.

Chickamauga—It is proposed to erect an ice factory with a capacity of 2,000 tons per day. The Crawfish Springs Land Co. can give information.

Columbus—Mr. A. Ellis has closed a contract with the Columbus Iron Works Co., for one 30-ton ice machine, to be erected at once.

Madison—A party from Birmingham will establish an ice factory. The mayor can give information.

St. Petersburg—The ice factory which has stood idle for several months, owing to lack of water, has been started up again.

ILLINOIS.

Chicago—The Canada Gas and Fuel Co. has been incorporated at Chicago, to manufacture gas, steam, ice, electricity, varnishes, paints, and smokeless fuel, to produce compressed air, and to do a mining business; capital stock, $5,000,000; incorporators, Thurston G. Hall, Patrick Dowling, Loftus E. Dancey and Thomas N. Dancey.

East St. Louis—The certificate of incorporation of the East St. Louis Ice and Cold Storage Co., capital $300,000, Messrs. Alonzo C. Church, Charles H. Sharman and W. S. Hodges incorporators, has been filed in the county recorder's office at Belleville.

East St. Louis—In reply to inquiry of Geo. W. Decker, president of a new cold storage company, in relation to taxes, Mayor Stephens replied that the city would guarantee by ordinance exemption from taxation for the next ten years. It is probable the cold storage warehouse will be erected.

Shelbyville—A number of Shelbyville capitalists are figuring on an ice plant.

INDIANA.

Lafayette—The Artificial Ice Co., started up this spring, has been so successful that the company has let the contract for another 60-ton machine, making total capacity next season of 100 tons daily. The company has purchased Wisconsin lake ice to fill foreign contracts; and at home has reduced last year's prices of 75c. to $1 per hundredweight to 25c. to 50c. per hundredweight.

KENTUCKY.

Danville—The ice factory has resumed operations, rains having filled their wells for water supply. The company is still drilling wells. Mr. Wm. Cheek, one of the largest stockholders, has sold out to the Sulzer-Vogt Co., of Louisville.

Mayfield—The Mayfield Construction Co. are in the market for an ice machine, which will be run in connection with the water works and electric light plant.

Newport—The Frigid Ice Co. was incorporated August 13; capital, $20,000; incorporators, Henry Voight, E. H. Conn, John Y. Conn; object, to make and sell ice and do a cold storage business. They now have a plant at work on Second street.

Winchester—A. J. and J. P. Cassity, of Mount Sterling, have leased property to remodel for an ice factory and cold storage plant.

LOUISIANA.

Abeta Springs—The ice factory is now in full operation, supplying Covington, in the same parish, three times a week.

Kentwood—A company is talked of to build an ice factory, to cost $12,000. The town has good shipping facilities on the Illinois Central road. The present ice supply comes from Geneva lake, Wis., and is handled by the Kentwood Box Manufacturing Co.

Lake Charles—The Lake Charles Ice, Light and Water Works Co., capital $100,000, has been organized by J. A. Landry and others to establish an ice factory, electric light plant and a system of water works.

Vidalia—An ice factory will probably be erected. Henry Vogt, of Sulzer-Vogt Co., Louisville, Ky., can give information.

MARYLAND.

Frederick—The Hygeia ice factory began making ice August 3. Their tank has ten tons daily capacity.

MICHIGAN.

Grand Rapids—The Grand Rapids Storage and Transfer Co. are thinking of putting in a freezer for game, and also general cold storage. They want information on the subject.

MISSISSIPPI.

Greenwood—The Leflore Ice Co. has, it is reported, added a 20-ton machine to its ice factory.

MISSOURI.

St. Louis—The Frick Co. is making an ice machine for St. Louis, with capacity of 100 tons of ice daily, besides refrigerating 200,000 cubic feet of cold storage room. The contract price is $193,800.

NORTH CAROLINA.

Washington—C. H. Sterling will erect an ice factory.

OHIO.

Washington C. H.—The Washington Ice Co. has been so successful since starting up in May last, that the company are thinking of doubling the capacity of the plant this winter. They use a 15-ton Stratton machine.

Circleville—There is some talk of starting an ice factory.

OKLAHOMA.

Ft. Reno—The new ice factory is said to be a success.

Guthrie—The Guthrie Ice Factory and Cold Storage Co. Jacob Schuehle, proprietor, and E. W. Morton, resident manager, established in 1890, at a cost of $20,000, is to be increased in capacity, which is now fifteen tons, as besides supplying Guthrie, the factory is building up a trade in the towns on the Santa Fe route.

OREGON.

Eugene City—The Union Cold Storage, Ice and Brewing Co., August 1, began the erection of an 8-ton ice factory, with cold storage and brewery in connection, the ice factory to be completed October 1. The Salmon machine has been purchased.

PENNSYLVANIA.

Allegheny—The Arctic Ice Co. has obtained a charter: capital stock, $300,000; incorporators, F. M. Aiken, John B. Chapman, Pittsburgh; Geo. H. Adams and Jas. B. Ross, Johnstown, Wm. F. Melhuisch, Allegheny; to manufacture ice.

Philadelphia—A local newspaper says: "One of the ice manufacturing companies located in Germantown is making extensive additions to its plant, with a view to producing ice on a larger scale. When the alterations shall have been completed new and powerful machinery will be put up, by means of which the company will be enabled to produce whole cakes of ice weighing a ton. The operation will be necessarily a long one, the freezing of one of these mammoth cakes occupying from ten to twelve days. Intricate machinery will also be erected for the purpose of cutting the ice into smaller cakes of any required size. Notwithstanding the great expense which will naturally be incurred by the erection of new machinery, the additions to the plant, and so on, the company has great expectations, claiming that the plan of making the cakes of larger size is a great improvement over the old method, being more economical."

TENNESSEE.

Johnson City—Graham & Co. will rebuild their ice factory recently burned.

TEXAS.

Myrtle Springs—The Texas Land and Industrial Co. will establish an ice factory.

Mineola—Is talking of a 10-ton ice factory, with cotton compress, etc.

Quanah—The city council has accepted a proposition for the construction of water works, erection of an electric light plant and ice factory.

San Antonio—The Southern Ice and Cold Storage Co. have finished their plant, and are operating two 30-ton ice machines, and cold storage buildings will be arranged for. H. L. Guenther is secretary.

Velasco—Two ice factories will, it is reported, be erected.

Vernon—The city has purchased and will operate the water works of the Vernon Ice, Light and Water Co.

Victoria—It is reported that the Southern Ice and Cold Storage Co., of Chattanooga, will erect an ice factory and cold storage establishment, and will ship fish and game, in car load lots, to all parts of the country.

VIRGINIA.

Harrisonburg—The Harrisonburg Ice Manufacturing Co. will enlarge its ice factory during the coming winter.

Manchester—The Manchester Transparent Ice Co. began making ice August 1, the trial of the machinery being very satisfactory.

Norfolk—Mr. Caleb Sterling is building a 7-ton ice factory.

Norfolk—The ice factory of G. and F. O. Rettig began making ice August 8. The Columbus, Ga., Iron Works (Stratton) machine is in use. The works are supplied with water from seven sixty-foot wells, which is vaporized, condensed and filtered through charcoal before freezing. The works are making thirty tons of ice daily, and represent $75,000 invested. It is claimed to be the largest ice factory in Virginia.

Richmond—The Home Ice and Coal Co. has been incorporated, with Warner Moore, president, and T. L. Moore, secretary, for the purpose of dealing in and mining coal, and dealing in and manufacturing ice, etc. The capital stock is to be not less than $25,000 and not more than $100,000.

MINOR LITIGATION.

—The People's Ice Mfg. Co., of New Orleans, was shut down July 29, for lack of funds. The company was organized in 1885, with a capital stock of $100,000, but last winter went into liquidation. In March, however, a new board of directors was elected, and the stockholders subscribed $40,000 in stock to continue business, of which sum, however, only $4,000 was paid in. Mr. Emile Kuntz was then elected president and Mr. Leon Sere, some time later, secretary. There are now anumber of judgments against the company, but creditors have taken no action, as the civil courts are closed. A meeting of the directors has been called for September 1, to decide the future of the business. Liabilities, $41,000; assets, $82,000.

——The Leavenworth (Kan.) Ice Plant and Cold Storage Co., composed of M. Ryan, Sr., and Geo. Ritcherson, was, August 4, sued by the York Mfg. Co., of York, Pa., to recover the sum of $15,660. The York company's agent then began removing the machinery, but were stopped by injunction, Mr. Ryan filing suit for counter claim, of damages for non-fulfillment of contract. Meantime, Mr. D. Atchison, who had contracted for the entire production of the plant, is short of ice, and he, too, threatens suit against some one.

——The Blymyer Ice Machine Co., of Cincinnati, made an assignment August 7, with liabilities at $320,000. The assets are stated to be considerably more than that. There are no preferences. The assignees are Edward Worthington and Frederick Busse. The cause of the failure is given as dull collections, owing to the long-time paper it is necessary to take from customers in this line of business, and pressing creditors. Those in a position to know say the company will undoubtedly pay dollar for dollar. The company succeeded about two years ago the Cincinnati Ice Machine Co., which also failed, but finally paid its creditors in full to a cent. The company will probably be reorganized and resume business.

MISCELLANEOUS NEWS ITEMS.

——New York's consumption of ice is estimated at 15,000 tons daily.

——Allen Smith's ice house at Plainville, Mass., was burned August 18; loss, $1,200.

——T. F. Brile's restaurant and ice house, Sweet Springs, Mo., was burned August 16.

——Mr. Keegan's city ice house at New Haven, Conn., was burned August 14. Loss, $500.

——The Forest City Ice Co.'s storage house, at Cleveland was burned August 15; loss, $8,000.

——One of the ice houses of the Crystal Ice Co., at Omaha, was burned August 19; loss, $1,500; insured.

——Mr. A. G. Labouser, late of Augusta, Ga., has gone to Salisburg, N. C., to managp the ice factory there.

——F. G. Guild's ice house at Silver Lake, Pittsfield, Mass., was burned August 19. Cause, incendiary; loss $1,000.

——The buildings of L. H. Mace and Co., makers of refrigerators, New York, were burned August 20; loss, $250,000.

——An ice company has been incorporated at Geneva, N. Y. A building, 300x30 feet, to hold 4,000 tons, will be erected.

——The San Angelo (Tex.) ice factory has shut down on account of scarcity of water, the river being lower than for many years.

——Geo. W. Taylor & Cos'. ice house at Norfolk, Va., was burned August 15; the business of the firm continues right on, however.

——The Wisconsin Lake Ice Co., Milwaukee, suffered a loss by fire, August 21, of $500 on building and $200 on stock; no insurance; cause, unknown.

——W. L. McCague's ice house, and 1,000 tons of ice owned by W. W. Man, were destroyed by fire, August 22, at Omaha: cause, supposed incendiary.

——The headquarters of the Colorado, Utah and Montana division of the American Refrigerator Transit Co. has been removed from Denver to Kansas City.

——The Alaska Refrigerator Co. are erecting at Muskegon, Mich., what is said to be the largest plant in the world for the exclusive manufacture of refrigerators.

——The Herrick Refrigerator and Cold Storage Co. have opened a factory at Wapello, Iowa, having all the territory west of the Mississippi for the McCray patent.

——Carl Goerg's ice houses at Michigan City, Ind., were burned August 18; loss, $1,400; cause, incendiary. Fred Kimball's house was also damaged to the amount of $200.

——The Consumers' Ice Co., Chester, Pa., has decided to issue $25,000 of additional stock, making a whole capital of $75,000; the proceeds of the sale to be used for enlarging the plant.

——The ice factory at Danville, Ky., have struck flowing water at sixty feet in their new wells. The flow is three gallons per minute. Nine other wells will be dug, which will give ample water supply.

——Mr. E. J. M. Hopkins, of New Birmingham, Texas, has sold his ice factory and cold storage houses to John Schwecler, of Omaha, for $6,000, and is now open for propositions from towns of 5,000 and upward that are willing to subscribe stock for an ice plant.

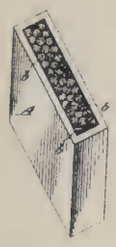
——George W. Decker, of Morrison & Decker, Newport, Ark., has been in St. Louis for some time past completing the organization of the East St. Louis Ice and Cold Storage Co. Capt. Decker was elected president of the company; Otto Stifel, vice-president, and W. S. Hodges, secretary and treasurer. The capital stock is $300,000. The factory will use the plate system, and have a capacity for making 100 tons daily.



We append below the most important new patents, relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

NON-HEAT-CONDUCTING COMPOUND.

No. 453,354. Hiram M. Hanmore, Santa Cruz, Cal. Filed April 7, 1890. Serial No. 346,826. Patented June 2, 1891. (No specimens.)



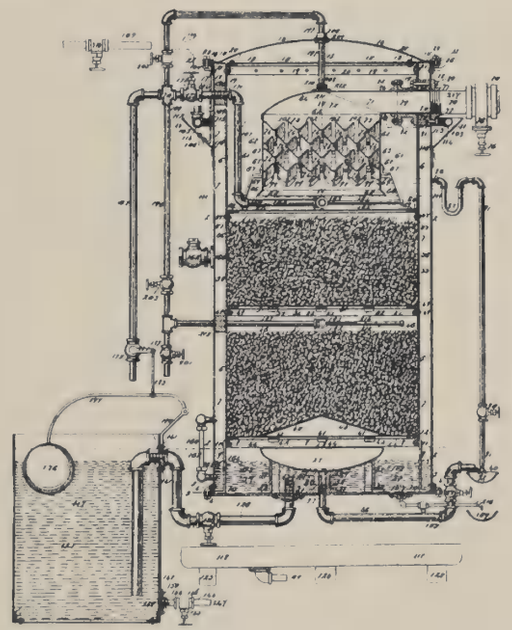
Claim—1. The herein described manufacture, composed of tule grass in the form of spires, tule grass in a granulated form, and a suitable binder for holding these parts in a mass, substantially as set forth.

2. The herein described manufacture, composed of tule grass in the form of spires, tule grass in the granulated form, tule grass in a fiberized form, and a suitable binder for holding these parts in a mass, substantially as set forth.

STEAM CONDENSER, ETC.

No. 456,464. Combined steam condenser, oil extractor and feed-water heater. Ferdinand Bauer, St. Louis, Mo. Filed November 21, 1890. Patented July 2 4, 1891. Serial No. 372,220. (No model.)

Claim.—1. The combination, with a steam condenser, of a series of staggered oil and grease trough-shaped traps *74*, the external reservoir into which said traps discharge, and the discharge pipe that conveys the trapped oil and grease from the condenser, substantially as and for the purpose set forth.

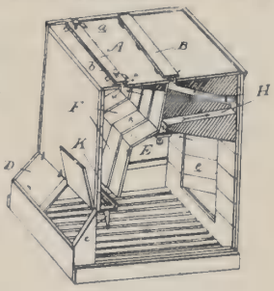


2. The combination of the exhaust steam supply pipe, the oil and grease trap box *62*, the inclined oil and grease trap troughs in said box, the external reservoir into which said traps discharge, and the discharge pipe *91*, that drains said reservoir, substantially as and for the purpose set forth

3. The combination of the casing having a water chamber therein, the exhaust steam supply pipe, the oil and grease trap bottomless box, into which the exhaust steam is forced, arranged above said water chamber, the multipartite surmounting and underlying tiers of angle-shaped inclined oil and grease trap troughs in said trap box, and the reservoir, independent of said water chamber, into which said troughs discharge, the said troughs being arranged in their tiers in staggered positions above each other and provided with intervening steam vents, through which the steam is forced in staggered currents while passing through said traps, substantially as and for the purpose set forth.

REFRIGERATOR.

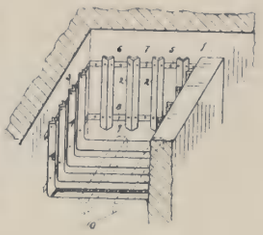
No. 456,840. John Outhet, Toronto, Canada. Filed February 24, 1891. Serial No. 382,499. Patented July 28, 1891. (No model.)



Claim—1. The combination, in a refrigerator, of a provision apartment and an ice chamber, the latter provided with a slanting ceiling to guide the warm air, and a long, narrow opening above, communicating with the outer atmosphere in two directions, whereby heated air passes out at one side and fresh air in at the other to ventilate the ice chamber, substantially as described.

REFRIGERATOR.

No. 457,962. Harry L. Trotter, Rochester, N. Y. Filed April 20, 1891. Serial No. 389,675. Patented August 11, 1891. (No model.)



Claim—1. In an ice chamber for refrigerators, and in combination with the walls thereof, the separate angle bars secured to the wall having the vertical and horizontal portions, the edges of said vertical portions co-operating with the walls and constituting vertical air passages open at their ends, and the horizontal portions serving as an ice support, substantially as described.

WANTED AND FOR SALE ADVERTISEMENTS.

[The charge for advertisements in this column is $1 each insertion for seventy words or less, and twenty-five cents for each additional fourteen words. No advertisements will be inserted unless accompanied by the necessary cash. Parties answering these advertisements must write to the addresses given, as the Publishers decline to furnish any information concerning them.]

Wanted.

Experienced salesman for refrigerating and ice making machinery. Address, giving references, Whitehill Engine & Pictet Ice Machine Co., Newburgh, N. Y.

Salesman Wanted.

An experienced ice machine salesman having good references, can obtain a good position by addressing "C. M. A.," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Wanted.

A young man of considerable experience desires a position as manager of some ice or cold storage company. Best reference given. Address Allen P. Walker, Wytheville, Va.

Foreman Wanted.

A first-class foreman with $10,000 to invest in a good paying ice factory in Kentucky. Address with references, "Ice Factory," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Wanted,

Situation wanted by a practical engineer in refrigerating or ice making. Ten years' experience. Will give best of references. Address G. A., care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Second Hand Ice Machine for Sale.

A second-hand ice machine, in first-class running order. Ice making capacity, twenty tons of ice per day. Will sell for $10,000. Address S. P. F., care of ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Situation Wanted.

An experienced engineer wishes to secure a situation in a northern state to run an ice or refrigerating machine. Understands the business thoroughly. Address "James W. M.," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Wanted.

A competent and reliable man, experienced in management of ice business, also practical machinist and mechanical engineer, now managing factory in Virginia, would like to locate further south as manager or superintendent of ice factory. Address R. I. C., care H. S. Rich & Co., Chicago, Ill.

For Sale.

On account of broken health, will dispose of my cold storage plant and business referred to on page 79, August number of this magazine. Been in successful operation five years. Storage capacity over 3,000 cases of eggs, or their equivalent. On paved street, with side track in rear. Near center of produce trade, and has every facility for carrying on commission business in connection with cold storage. Any man having money to run this plant and business properly, can clean up from $10,000 UPWARD in clear profits YEARLY, according to his push and energy. Cost, $8,000; will discount for cash, or trade for real estate. For particulars, write D. B. Beemer, 807 Howard street, Omaha. (Population, 140,000.)



ICE · TOOLS

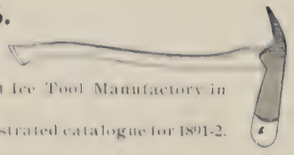
FOR HARVESTING AND FOR DELIVERING ICE.

Of Every Description.

MANUFACTURED BY **WM. T. WOOD & CO.**

ARLINGTON, MASS.





The oldest and largest Ice Tool Manufactory in the United States.
Send for complete illustrated catalogue for 1891-2.

CRANE COMPANY, CHICAGO.

SPECIAL **WROUGHT IRON PIPE**

For Ice Making and Cold Storage.

GEM CITY ICE CO. QUINCY, ILL.

WHOLESALE DEALERS IN

PURE . . . NORTHERN **LAKE ICE**

DO YOU WANT ICE IN CAR LOADS?
WE HAVE IT FOR SALE.

Special attention given to packing and covering for long distance shipments. Correspondence solicited.

C. D. VAN FRANK, M'G'R.

HILPERT & CHANDLER

ENGRAVERS

BY ALL PROCESSES.

REFER TO CUTS IN THIS PAPER FOR SPECIMENS OF WORK.

167 DEARBORN ST. CHICAGO.

JOHNSON, McCARTHY & JOHNSON,

MANUFACTURERS OF

THE JOHNSON COMPOUND

Ammonia Compressor

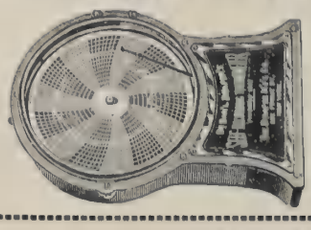
AND

ICE AND REFRIGERATING MACHINES

Office, Room 76, Worcester Block,

PORTLAND, OREGON.

DRAPER'S SELF-RECORDING **THERMOMETER**



This instrument is especially adapted for use in cold storage warehouses and freezing rooms, for keeping a correct and continuous record, in ink, of the temperature, affording absolute proof of the temperature maintained.

Size 14x20 in. Price, $30.
Size 9x14 in. Price, $15.

Write for particulars.

THE DRAPER MFG. CO.
152 Front St., NEW YORK.

MINERAL WOOL

BEST INSULATOR FOR . . . . .

ICE HOUSES, COLD STORAGE ROOMS, ETC.

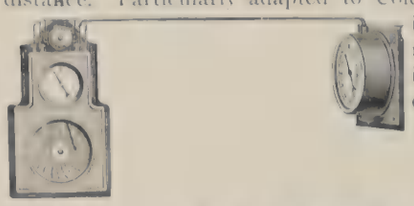
REFERENCES ON APPLICATION.
SAMPLES FREE . . . . .

U. S. MINERAL WOOL CO.

2 CORTLANDT ST., N. Y. CITY.

Telemeter Instruments.

For recording and indicating temperature and pressure at a distance. Particularly adapted to Cold Storage, to indicate in the office or engine room the temperature in any or all the refrigerating rooms.

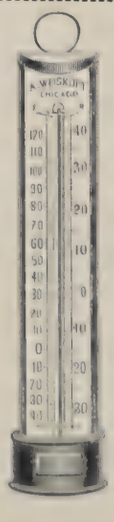


FOR DESCRIPTION AND PRICES SEND TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Courtlandt St. Boston Office, 70 Pearl St.



A. WEISKOPF

111 Fifth Ave., CHICAGO,

MANUFACTURER AND IMPORTER OF

THERMOMETERS

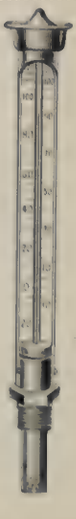
AND **HYDROMETERS.**

Ice Machine Thermometers and Ammonia Hydrometers . . . .

CELLAR AND . . . . . CHILL ROOM THERMOMETERS.

Thermometers in angle shape made to order from sketch or specification.

ESTIMATES FURNISHED ON APPLICATION.



THIS ENGRAVING REPRESENTS THE WORKS OF THE

Blymyer Ice Machine Co., Cincinnati, Ohio.

Manufacturers of Ice and Refrigerating Machines, exclusively. The Absorption Machine, made by the Blymyer Ice Machine Co., is superior to any Compression Machine, either as a Refrigerating or Ice-Making Machine. It requires no steam engine or complex moving machinery. It saves 25 to 40 per cent of the fuel, and saves ammonia and labor. The cost of repairs is small, and the machine will outlast Compression Machines several times over. It is not necessary to buy these machines in pairs, as there is no danger of serious stoppage. These machines are ***RADICALLY DIFFERENT*** from all other Absorption Machines, and are in every way superior to them.



BELOW will be found a list of Ice-Making and Refrigerating Machines made by us. Every one of these machines has been in continuous use since erected, and is in use now. None have failed to fill their guarantees satisfactorily; none have been superseded by other machines. The entire capacity of our works having, up to the present time, been taken up with the manufacture of Ice-Making Machines, no agents have solicited orders for Refrigerators. Such orders as have been taken have been merely incidental. Having easily taken the lead in the Ice-Making Machine field, the manufacturers, with their enlarged capacity, will now enter the Refrigerator field (which is much the easier of the two in which to make a good record) in earnest, and respectfully solicit correspondence. Send for our catalogue.

ICE-MAKING MACHINES.

No.	Size.	NAME.	ADDRESS.
1	½ Ton.	Meridian Ice Mfg. Co.	Meridian, Miss.
1	10 "	Baton Rouge Ice Mfg. Co.	Baton Rouge, La.
1	15 "	Evansville Ice and Cold Storage Co	Evansville, Ind.
1	5 "	A. Moresi	Jeanerette, La.
1	15 "	Lookout Ice and Cold Storage Co	Chattanooga, Tenn.
1	10 "	Morris Ice Co.	Jackson, Miss.
1	15 "	Texarkana Ice Co	Texarkana, Tex.
1	30 "	Lookout Ice & Cld. Stor. Co. (2d Order	Chattanooga, Tenn.
1	5 "	Gadsden Ice Co	Gadsden, Ala.
1	6 "	Sheffield Ice Co	Sheffield, Ala.
1	5 "	Decatur Ice Co	Decatur, Ala.
1	20 "	Crystal Ice Co	Wichita, Kan.
1	3 "	Denton Ice Co	Denton, Tex.
1	5 "	Van Buren Ice and Coal Co	Van Buren, Ark.
1	5 "	Biloxi Artesian Ice Mfg. Co.	Biloxi, Miss.
1	25 "	Hutchinson Ice Mfg. Co	Hutchinson, Kan.
1	12 "	Parkersburg Ice Co	Parkersburg, W.Va.
1	20 "	Union Ice Co	Denver, Col.
1	3 "	Dominick & Karston	West Point, Miss.
1	3 "	DeCoppet Ice Co	Somerset, Ky.
1	35 "	Evansv'le Ice & Cld.Stor.Co.(2d Order	Evansville, Ind.
1	2 "	Van Horn & Chambers	Lebanon, Ohio.
1	4 "	John C. Webb	Demopolis, Ala.
1	12 "	Huntington Ice and Storage Co	Huntington, W.Va.
1	15 "	Corryville Artificial Ice Co.	Cincinnati, Ohio.
1	3 "	Tupelo Ice Co	Tupelo, Miss.
1	20 "	Wheeling Ice and Storage Co.	Wheeling, W.Va.
*1	10 "	Ft. Payne Ice and Cold Storage Co.	Ft. Payne, Ala.
*1	10 "	Coronado Beach Co. (Hotel del Coronado)	San Diego, Cal.
*1	1 "	Walter Aiken (Hamilton Hotel)	Hamilton, Bermuda
*1	20 "	Decatur Cold Storage and Ice Co.	Decatur, Ill.
*1	12 "	Marietta Ice Co	Marietta, O.
*1	35 "	Dayton Ice Mfg. & Cold Storage Co	Dayton, O.
*1	30 "	Zanesville Artificial Ice Co.	Zanesville, O.
*1	35 "	Evansv'le Ice & Cld.Stor.Co.(2d Order.	Evansville, Ind.
*1	3 "	Connolly & Curtis,	Columbus, Miss.
*1	5 "	Lebanon Artificial Ice Co.	Lebanon, Ky.
*1	5 "	Cynthiana Elec. Light & Power Co	Cynthiana, Ky.
*1	5 "	Grenada Cream'y, Cld.Stor.&Ice.Co	Grenada, Miss.
*1	15 "	Washington Ice Co	Washington, Ind.
*1	20 "	Wheeling Ice & Storage Co.(2d Order)	Wheeling, W.Va.
*1	32 "	Consumers Ice Co.	San Francisco, Cal.
*1	15 "	Shelbyville Artificial Ice Co	Shelbyville, Ind.
*1	30 "	Pueblo Distilled Water Ice and Cold Storage Co.	Pueblo, Col.
*1	15 "	Skinner & Olson	Topeka, Kan.
*1	35 "	Fort Wayne Artificial Ice Co.	Fort Wayne, Ind.
*1	35 "	Evansv'le Ice & Cld.Stor.Co. 4th Order)	Evansville, Ind.
*1	50 "	Dayton Ice Mfg. & Cd.Sto.Co.(2d Order	Dayton, O.
*1	15 "	Ashland Artificial Ice Co.	Ashland, Ky.
*1	50 "	Corryville Artificial Ice Co. (2d Order	Cincinnati, O.

* These machines were erected in 1890.

ICE-MAKING MACHINES.

No.	Size.	NAME.	ADDRESS.
**1	½ Ton.	Gibson House	Cincinnati, O.
**1	10 "	Palace Hotel	San Francisco, Cal.
**1	20 "	The People's Ice Co	Birmingham, Ala.
**1	35 "	Citizens Ice Co.	Los Angeles, Cal.
**1	20 "	Civil & White	Colorado Spr'gs, Col.
**1	30 "	Pueblo D.W. Ice & Cd.S.Co. (2d Order,	Pueblo, Col.
**1	60 "	Colorado Ice and Storage Co	Denver, Col.
**1	25 "	E. B. Cornell	Tampa, Fla.
**1	5 "	Mr. H. G. Meumann	Bessemer, Ala.
**1	20 "	Consumers Ice Co.	Vicksburg, Miss.
**1	25 "	Artificial Ice and Storage Co	Canton, O.
**1	12½ "	Frigid Ice Mfg. Co.	Joplin, Mo.
**1	30 "	Crystal Ice Co.	Albuquerque, N. M.
**1	15 "	Meridian Ice Co. (2d Order)	Meridian, Miss.
**1	3 "	Dayton Ice Co	Dayton, Tenn.
**1	15 "	Decatur Ice Co. (2d Order)	Decatur, Ala.
**1	12½ "	The Ruddick Artificial Ice Co.	Columbus, Ind.
**1	10 "	Mr. August Erath	New Iberia, La.
**1	55 "	The Crystal Ice Mfg. & Cd. Sto Co.	Columbus, O.
**1	32 "	Consumers Ice Co. (2d Order).	San Francisco, Cal.
**1	15 "	Peru Ice and Cold Storage Co	Peru, Ind.
**1	55 "	The Crystal Ice Mfg. and Cd. Stor Co. (2d Order)	Columbus, O.
**1	32 "	Lafayette Artificial Ice Co.	Lafayette, Ind.
**1	50 "	R. T. McDonald & Judah Hart	New Orleans, La.
**1	12 "	John Hoey (Hollywood Hotel)	Long Branch, N. J.
**1	15 "	Bridgeport Electric and Ice Co	Bridgeport, [illegible]
**1	"	Fleischman & Co.	Cincinnati, O.

** These machines were erected in season 1891.

REFRIGERATING MACHINES.

2	50 Ton.	Louisiana Brewing Co.	New Orleans, La.
1	40 "	Toledo Brewing and Malting Co.	Toledo, O.
1	40 "	Hudepohl & Kotte (Brewery)	Cincinnati, O.
1	50 "	Savannah Brewing Co	Savannah, Ga.
1	25 "	Schantz & Schwind (Brewery	Dayton, O.
1	15 "	John Smith's Sons (Brewery)	Youngstown, O.
1	12 "	Christ Diehl (Brewery)	Defiance, O.
1	12 "	Genessee Oil Works	Buffalo, N. Y.
1	12 "	S. Davis, Jr., & Co. (Packers	Cincinnati, O.
1	50 "	Occidental Packing & Provision Co	Lincoln, Neb.
1	15 "	Thos. McFadden, Jr. (Cold Storage	Pittsburgh, Pa.
1	15 "	Grocers' Supply Co. (Cold Storage)	Pittsburgh, Pa.
*1	40 "	Adolph Coors (Golden Brewery	Golden, Col.
*1	20 "	F. Conrad (Brewery)	Anaheim, Cal.
*1	25 "	The Sachs-Prudens Ale Co	Dayton, O.

* These machines were erected in 1890.

DIRECTORY OF

Ice Factories, Ice Dealers and Cold Storage Houses.

THE PICTET ICE WORKS,
Manufacturers of Artificial Ice from Filtered and Double Distilled Lake Erie Water.
Capacity, 30 tons per day.
20, 22 & 24 Center St., Cleveland, O.

THE WASHINGTON MARKET CO.
Central, accessible and close to business, with over 300,000 feet cold storage space.
Center Market: 7th and Pa. Ave., N. W.,
Washington, D. C.

CENTRAL ICE CO.
REPRESENTING Lookout Ice & Cold Storage Co.
Chattanooga Ice & Bottling Co.
Ice Capacity, Big Spring Ice Co.
125 Tons daily. Chattanooga, Tenn.

NORTHWEST COLD STORAGE & ICE CO.
WM. McGUIRE, Sec'y and Treas.
C. H. PRESCOTT, Pres. J. C. LEWIS, Vice-Pres.
WM. McGUIRE, Mgr. Portland, Ore.

STANDARD ICE CO.
Daily capacity, 135 tons.
Office: Wall Street.
Factories: Atlanta, Iceville and West End.
MORRIS BENJAMIN, Mgr. Atlanta, Ga.

J. WALTON CURTIS,
ICE BROKER,
Ice bought and sold on commission.
P. O. Box 1264. Boston, Mass.

EXCELSIOR ICE & COLD STORAGE CO.
Ice capacity, 80 tons daily.
W. H. HOWE, Prop. Nashville, Tenn.

GEORGIA ICE CO.---N. O. ICE MFG. CO.
Capac'y, 40 tons daily. Capac'y, 80 tons daily.
J. M. BEATH, Gen. Mgr. H. H. BLANK, Supt. N. O.
Atlanta, Ga. New Orleans, La.

JAMES McCARTHY & SON,
Wholesale and Retail dealers in Ice,
Winter and Summer Shipments,
Lake Bras D'Or, Nova Scotia.

GIFFORD BROS.

HUDSON, NEW YORK.

ICE

ELEVATING
CONVEYING
LOWERING

Send for Catalogue and Price List.

MACHINERY

ALSO

CHAIN, FORGINGS, ENGINES AND BOILERS.

THE GARLOCK PACKING CO.

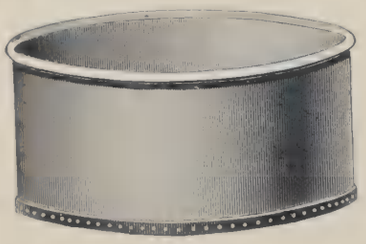
ELASTIC RING, SECTIONAL AND SPIRAL PACKINGS
ESPECIALLY ADAPTED FOR STEAM, WATER, AMMONIA AND ALL PLACES WHERE PACKINGS ARE USED.
EQUALED BY NONE



PALMYRA, N.Y. ROME, GA. OMAHA, NEB. | PITTSBURGH 54 5th AVE | NEW YORK 194 WATER ST. | CHICAGO 94 FRANKLIN ST. | PHILADELPHIA 22 & 24 N. 4th ST. | PORTLAND, ORE.

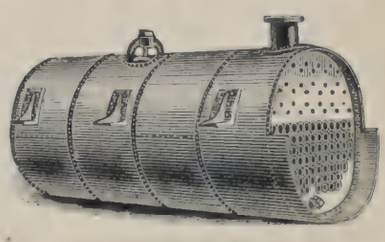
LANSING-IRON AND ENGINE-WORKS

LANSING, MICH.



MANUFACTURERS OF

COMPOUND
CONDENSING
AUTOMATIC
ENGINES.



CORRESPONDENCE SOLICITED

BOILER AND SHEET IRON AND TANK WORK

For Ice Makers and Cold Storage Plants a Specialty.



NEW FEED-WATER PURIFIER AND HEATER

USES LIVE STEAM

This cut shows our Feed Water Heater and Filter combined. Perfectly purifies the feed-water and delivers it to the boiler freed from scale producing elements and sediment. FULLY GUARANTEED.

STILWELL'S PATENT IMPROVED

Lime Extracting Heater. Uses Exhaust Steam. Separates the oil from the Steam and Water. It Regulates the Feed. The Pipes Never Pound. Prevents Scale in Steam Boilers, removing all Impurities from the water before it enters the Boiler.

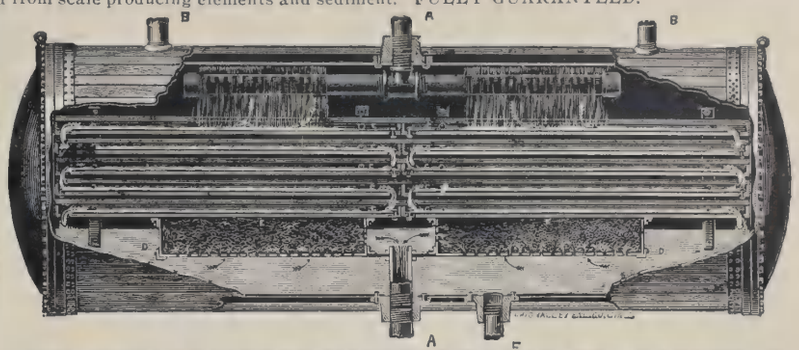
THOROUGHLY TESTED.

Over 4,500 of them in daily use.

This upright view is a fac-simile of the appearance of the shelves of a No. 5 Heater at work on ordinary Lime Water, when the door was removed after the Heater had been running two weeks.

ILLUSTRATED CATALOGUE FREE.

ESTABLISHED IN 1866.....



STILWELL & BIERCE MANUFACTURING CO., DAYTON, O.

THE P. FLEMING COMPANY

A. TSCHOPIK & SON, Proprietors.

IRON PIPE, FITTINGS AND BRASS GOODS

SEND FOR PRICE LIST AND DISCOUNTS.

A full line of Asbestos Rubber and other Packing suitable for Ice Machines.

CHATTANOOGA, TENN.

A. W. SWANITZ, CONSULTING ENGINEER,

AND EXPERT IN

Ice AND Refrigerating Machinery

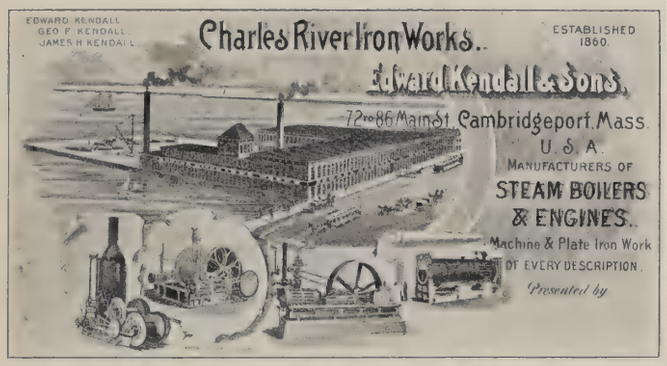
CORRESPONDENCE SOLICITED . . .

701 STOCK EXCHANGE BUILDING,

CHICAGO.

TANKS AND SHEET IRON WORK

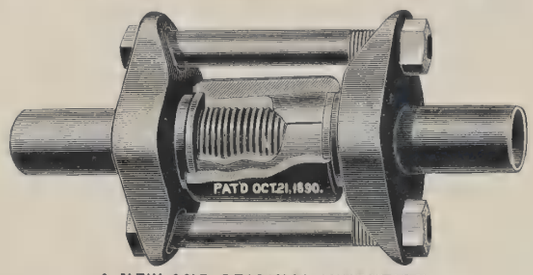
OF EVERY DESCRIPTION.



CONTRACT FOR THE COMPLETE EQUIPMENT OF

ICE MAKING AND COLD STORAGE PLANTS.

THE CLIMAX COUPLING



A NEW AND ORIGINAL INVENTION.

Unsurpassed for Efficiency, Strength, Durability and Economy.

Investigation will establish its superiority over every other known pipe-joint, particularly for Ice and Refrigerating Plants using ammonia. For further information, testimonials, prices, etc., address

ENOCH LAWSON,

229 FULTON STREET, SAN FRANCISCO, CAL.

STROMBERG, ALLEN & Co.

RAILROAD AND COMMERCIAL **Printers**

ENGRAVERS
LITHOGRAPHERS
ELECTROTYPERS

MANUFACTURERS OF

LIGHT RAILROAD SUPPLIES

Consecutively Numbered Tickets, Bonds, Checks, etc., a specialty

PRINTERS OF ICE AND REFRIGERATION

337 AND 339 DEARBORN ST., CHICAGO



AUG. OHLSEN. JOS. MECKLER.

QUEEN CITY Omnibus and Wagon MFG. CO.

Builders of all Kinds of Vehicles.

Cor. Charles and Plum Sts.,

CINCINNATI, O.

SELDEN'S PATENT PACKINGS



FOR STUFFING BOXES

The BEST Packing for Ammonia, Air, Steam or Water. Used in Ice and Refrigerating Plants in this and other countries. Give it a trial. If your supply store does not keep it in stock, ask him to get it from the manufacturer.

RANDOLPH BRANDT,
38 Cortlandt St.,
New York, U. S. A.

IMPORTANT TO ICE MAKERS.

✻ TRI-SODIUM PHOSPHATE CHEMICAL WATER PURIFIER. ✻

PATENTED

A staple salt for the purification of water, ***HOT*** or ***COLD,*** free from injurious action to ice, water or metals.
It prevents incrustations in boilers, and yields an absolutely pure steam for condensing and freezing.
It will prevent incrustations or corrosion to cooling coils, when applied to water passing over them.

By its use the impurities are rapidly eliminated from hot or cold water, by precipitation in tanks, producing a clear, soft, wholesome water for freezing or other purposes.

Send for our book "Worth Knowing," containing valuable information on ***Water Treatment.***

KEYSTONE CHEMICAL COMPANY, Patentees and Manufacturers,

3 South Front Street, PHILADELPHIA. — 65 South Canal Street, CHICAGO.

STRONG TESTIMONY

KEYSTONE CHEMICAL CO.

CHAMPION ICE MANUFACTURING AND COLD STORAGE CO.
COVINGTON, KY., June 27, 1891.

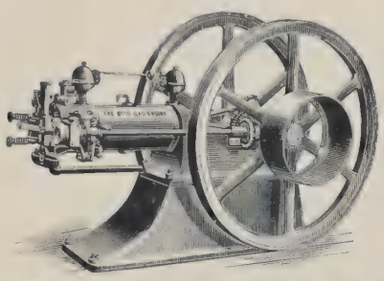
Gentlemen: In answer to your inquiry as to how we like your Tri-Sodium Phosphate, will say that we have been using it for two years with the best of results, both here and at our plant in Ironton, O. We find that it keeps our boilers clean, and the condensed steam from them is absolutely pure, and therefore does not affect the ice manufactured from it in the least. Condensed steam from boilers usually carries an insipid, smoky or bitter flavor with it into ice, but this is entirely overcome. We have the reputation of having the best artificially manufactured ice in this country; it is clear, odorless and tasteless, in fact absolutely pure, and we "bank" our last dollar on your Tri-Sodium Phosphate

Yours truly,
(COPY) R. W. DUGAN, Sup't and Treas. CHAMPION ICE MFG. & COLD STORAGE CO.

OTTO

Gas and Gasoline Engines

OVER 33,000 IN USE



BEST AND CHEAPEST POWER FOR

Refrigerating Machines

No Skilled Attendance.
No Boiler, Heat or Danger.
Started at once for short or long duty.
Sizes, ½ to 100 horse-power.
Can be used in country or city.

OTTO GAS ENGINE WORKS, 33d and Walnut Sts., PHILADELPHIA. 151 Monroe St., CHICAGO.

....THE....

HEERDEGEN WATER INDICATOR

We make investigations for subterranean water and furnish reports as to the number of streams, their exact width, direction of flow, approximate depth below the surface, and quantity of flow.

The great advantage of having a well located, is:

1. We locate wells only at such places where we find subterranean FLOWING streams; this is a full guarantee of getting wells, which will never drop off or give out in time of drought, which is the case where wells are supplied by seepage water only.
2. We can follow the course of a subterranean stream for any distance and select the proper place to sink the well.
3. We state the approximate depth of the stream below the surface, which enables our customers to make an estimate of the cost for sinking the well by the foot.
4. Where the supply of an ARTESIAN WELL is obtained from a running stream or a spring, instead of seepage water, in NINE CASES OUT OF TEN IT IS OF GOOD QUALITY.
5. If there are any springs in the neighborhood where a well is wanted, we can trace the underground outlets of same or the supplying flow for any distance.
6. Where water of low temperature is wanted for cooling purposes, such as for BREWERIES, ICE FACTORIES, distilleries, oil refineries, etc., none cooler than artesian well water exists.
7. Our method of locating wells eliminates all and every risk of failure.

Estimates are given for sinking wells, with guarantee of water, where supply from artesian wells is desired.

We have successfully located a large number of wells.

For particulars apply to

HEERDEGEN & SCHNEE,

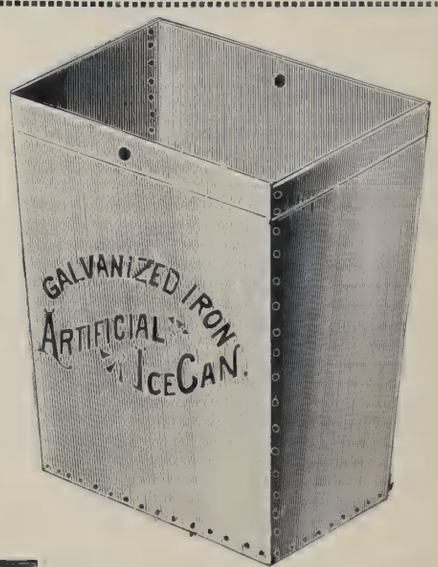
48 EXCHANGE PLACE, - - - NEW YORK.

CAPACITY 300 PER DAY.

ICE "CANS" GALVANIZED IRON

WE MAKE THEM BY THE THOUSANDS FOR ICE MFRS. BREWERS AND FOR THE TRADE READ TESTIMONIALS.

WRITE FOR PRICES



NEWBURGH, N. Y., November 29, 1890.

I desire to say that I am pleased with the Ice Cans you have furnished me and they have proved satisfactory to my customers.

ROBERT WHITEHILL,
Manufacturer of Engines and General Machinery.

DAYTON, OHIO, November 28, 1890.

The Ice Cans with which you furnished us in the summer of 1890 have been in constant use during the entire Ice Manufacturing season of 1890, giving entire satisfaction. The material and workmanship could not have been better, and to-day the cans are as good as when shipped from your factory. We can faithfully recommend your cans.

C. SCHWIND,
Dayton View Brewery.

SEE TESTIMONIALS NEXT ISSUE.



GROUND FLOOR SPACE 110X210 FT.

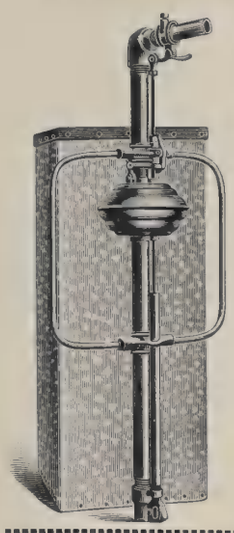
Established 1861. Incorporated 1890.

THE

KIECHLER MFG. CO.

LINN, EVERETT and CLINTON STS.

CINCINNATI, O.



E. C. SAULS. C. G. SAULS.

SAULS BROS.

MANUFACTURERS OF

Sauls' Automatic Ice Can Filler

Fills Automatically and prevents flooding the bath. Save time, labor and money. Over

: : 150 : :

In use in prominent factories. Send for testimonials and prices.

SAULS BROS.

COLUMBUS, GA.

SEIBEL-SUESSDORF

COPPER AND IRON MFG. CO.

MANUFACTURERS OF

Sheet Iron Tank Work

FOR ICE FACTORIES, PACKERS, ETC.

Also Manufacturers of Galvanized Iron . .

ICE CANS

SEND FOR ESTIMATES.

N. E. CORNER SECOND AND LOMBARD STREETS.

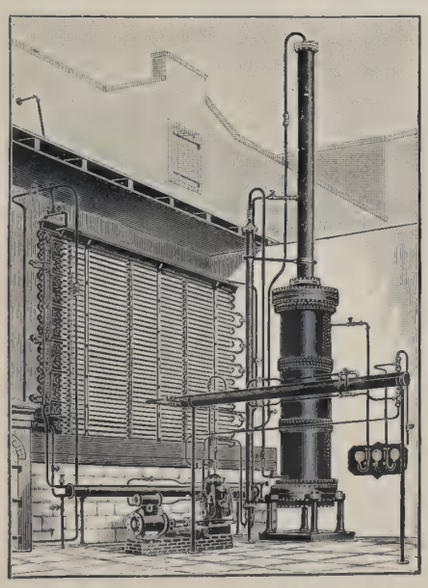
ST. LOUIS, MO.

PENNSYLVANIA IRON WORKS COMPANY,

.....MANUFACTURERS OF....

Ice AND Refrigerating Machines

EMBODYING THE LATEST IMPROVEMENTS IN ABSORPTION MACHINES.



Ice Machine References

W. H. RAGAN, Thibodaux, La.
HENRY COOK, Donaldsville, La.
GEO. & J. G. MUEHLEBACH, Kansas City, Mo.
LAUER BREWING CO., Reading, Pa.
STEGMAIER & SON, Wilkes Barre, Pa.
J. H. MICHENER & CO., Philadelphia, Pa.
EDSON BROS. Cold Storage, Philadelphia, Pa.
"GLADSTONE" APARTMENTS, Philadelphia, Pa.
THOS. BRADLEY, Cold Storage, Philadelphia, Pa.
FRAISSI & BLUM, Ice Manuf'rs, Houma, La.

AND MANY OTHERS.

SATISFACTION AT LOWEST COST GUARANTEED.

Plans and estimates for plants erected ready for operation cheerfully given on application.

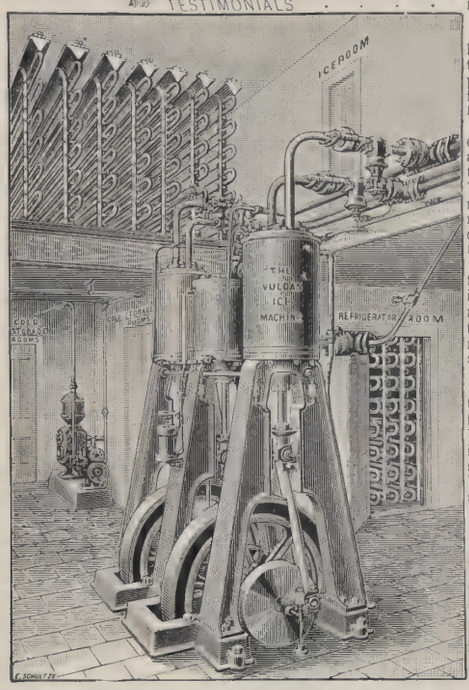
Office and Works, 50th Street and Merion Avenue,

PHILADELPHIA, PA.

NEW YORK OFFICES, 9 AND 11 WALL STREET.

The "VULCAN" Ice and Refrigerating Machine,

TESTIMONIALS



ENTERPRISE BREWERY, San Francisco:
"The 24-ton Refrigerating Machine has been running continuously since 1887, and has proved economical and satisfactory in every respect."

HOTEL DEL MONTE, Mont'y:
"The Ice Machine now in operation at Hotel Del Monte is and has been since its completion a very satisfactory plant. We take pleasure in cordially recommending this variety of machine to any who may require its use."

HOTEL RAFAEL, San Rafael:
"The 'Vulcan' Ice and Refrigerating plant is as satisfactory in every respect, and is doing more work than was guaranteed. A model of good workmanship. The ice is clear."

SOUTH SAN FRANCISCO PACKING & PROV. CO.:
"It gives us pleasure to state that the Refrigerating plant furnished by the Vulcan Iron Works for our packing house, in 1886, has been in operation since then, and has given the best results, to our complete satisfaction."

MILK RANCH, Penn's Grove, Cal.:
"We have been for the past year, and are now using, a 'Vulcan' Refrigerating Machine, manufactured by the Vulcan Iron Works, for the purpose of cooling from 800 to 1,000 gallons of milk per day, shipped to San Francisco and San Rafael, and find the work done by it entirely satisfactory."

THE VULCAN IRON WORKS, 135-145 Fremont St., San Francisco, Cal.

WINGATE & MELL,

MANUFACTURERS OF : : : **ICE-CANS**

WRITE FOR ESTIMATES.

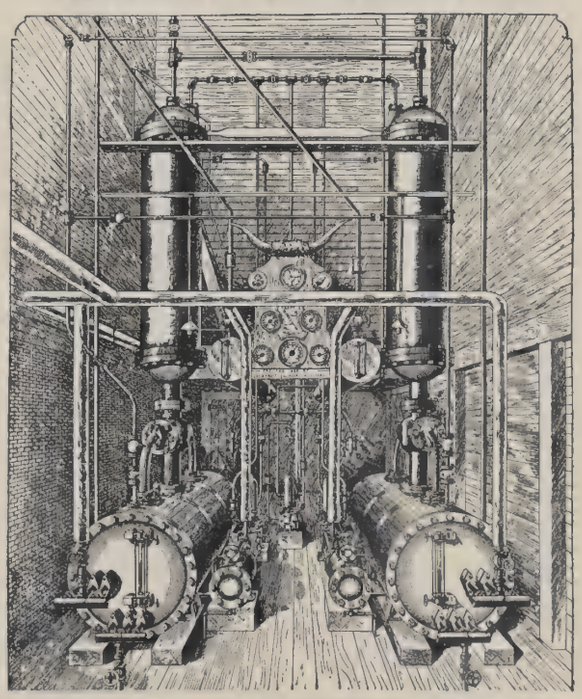
44 & 46 North Broad Street, **ATLANTA, GA.**

Ice AND Refrigerating Machines

FOR . ICE-MAKING . PLANTS

Brewers, Pork Packers, Oil Refiners, Cold Air Store Houses, and all Purposes where a low degree of temperature is required.

Builder of Machinery for Packers, Butchers and Produce Dealers.



Dealer in Engines, Boilers, Pumps and Steam Specialties.

ENGINEER AND CONTRACTOR

Descriptive Circulars, References, Detailed Estimates and Information furnished on Application . . . . . .

JAMES B. CRAFT,

74 CORTLANDT ST. NEW YORK.

THE WESTERN ICE MACHINE CO.

OTTO HOFFMANN, PROPRIETOR.

Ice AND Refrigerating Machinery

FOR BREWERIES, PACKING HOUSES, ICE FACTORIES,
COLD STORAGE PLANTS, MARKETS, CONFECTIONERS, ETC.

Every Part Accessible While in Motion. . . . . .
The Most Cooling with the Least Expense. . . . .

THIS machine is the simplest, cheapest in first cost and after expense, is more easily handled than any other, and takes less room. Absolutely no possibility of leaking Ammonia. Machines of any capacity from smallest to the largest. We would be pleased to make Estimates, and believe we can show you a saving in cooling your cellars. . . . . .

WESTERN ICE MACHINE CO.

Office, Room 605 Northern Office Building, Cor. La Salle and Lake Sts.,

See this space next issue for Illustration of Machine.

CHICAGO, ILL.

ICE MACHINES

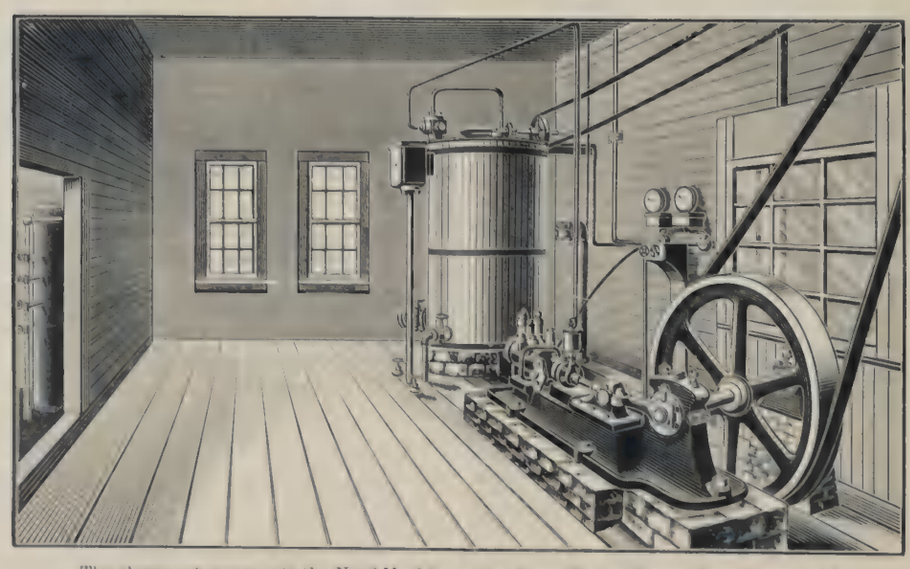
(WINDHAUSEN'S SYSTEM.)

AINSLIE, COCHRAN & CO.

LOUISVILLE, KY.

To the Trade . . . .

We have recently secured the sole right to manufacture and sell WINDHAUSEN'S CARBONIC ANHYDRIDE ICE AND REFRIGERATING MACHINES in the United States. These machines have gained a wide reputation on the continent for their simplicity, durability and economical running. They have been indorsed by the German government, an eighty (80) ton machine having been placed in the powder works at Spandau. They are also fast superseding other systems in the prominent breweries of Germany, nearly 200 being in operation already. They are the only machines using carbonic anhydride, which has such a great range of expansion, produces such intense cold, and is cheap, odorless and easily obtained

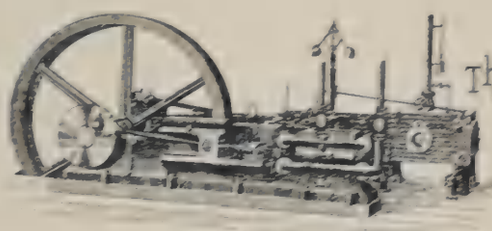


The above cut represents the No. 2 Machine at the Terre Haute House, Terre Haute, Ind.

WRITE TO US FOR FURTHER PARTICULARS

AINSLIE, COCHRAN & CO.

REFRIGERATING PLANTS



The Weisel & Vilter Mfg. Co.

Manufacturers of

CORLISS ENGINES,

Machinery for Brewers and Bottlers.

ICE MAKING & REFRIGERATING MACHINERY.

ICE-MAKING PLANTS

FOR BREWERIES, PACKING HOUSES CONFECTIONERIES, COLD STORAGE HOUSES, ETC.

Direct Expansion or Brine System

MILWAUKEE, WIS.

Van Winkle Gin & Machinery Co.

MANUFACTURERS OF

THE KEELING ..AUTOMATIC.. ICE MACHINE

FOR ICE MAKING, COLD STORAGE PLANTS, BREWERIES, PACKERS, ETC.

WRITE FOR ESTIMATES AND FURTHER INFORMATION.

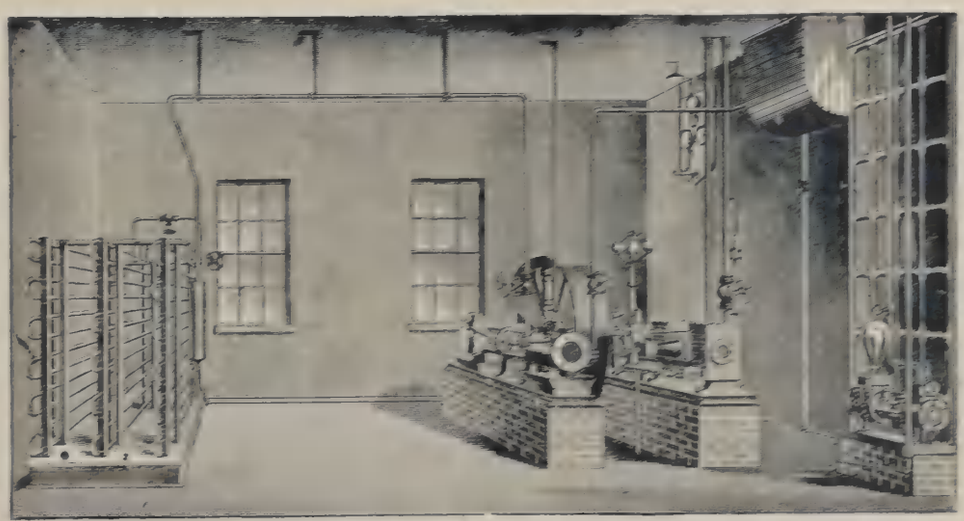
VAN WINKLE GIN AND MACHINERY CO.

OFFICE, 210 MARIETTA STREET, ATLANTA, GA.

The American Ice Machine Company

SOLE OWNERS OF THE KLINE AND WINKLER AUTOMATIC

REFRIGERATING AND ICE MAKING MACHINE SYSTEM



Simplicity of Construction.
Durability.
Efficiency,
Economy.

ICE-MAKING OR REFRIGERATING PLANTS

From One Ton to Two Hundred Tons daily capacity

Over 100 MACHINES IN OPERATION

1. **The simplicity of construction.** Every part is simple and complete, is exposed to full view, easily got at and can be readily understood and handled by an engineer of ordinary intelligence.

2. **The freezing process is completely automatic** (WHICH NO OTHER FREEZING SYSTEM POSSESSES), through the action of our patent expansion pressure regulator; it saves valuable working time. Every part is independent of the other, and can be overhauled or replaced without stopping the whole machine.

3. **That ice is manufactured from distilled water,** which is free from disease-producing germs, such as found in ice frozen on rivers and ponds, is self-evident; pure, cool is infinitely preferable to the natural product.

4. Our Patent Gas Condenser enables us to work with warmer water and less water than any other machine, as the water is supplied [illegible] without waste or using any tube connections.

5. We can make more ice or cold air than any other system WITH THE SAME AMOUNT OF FUEL. Experts have proved the difference to be from 25 to 40 per cent.

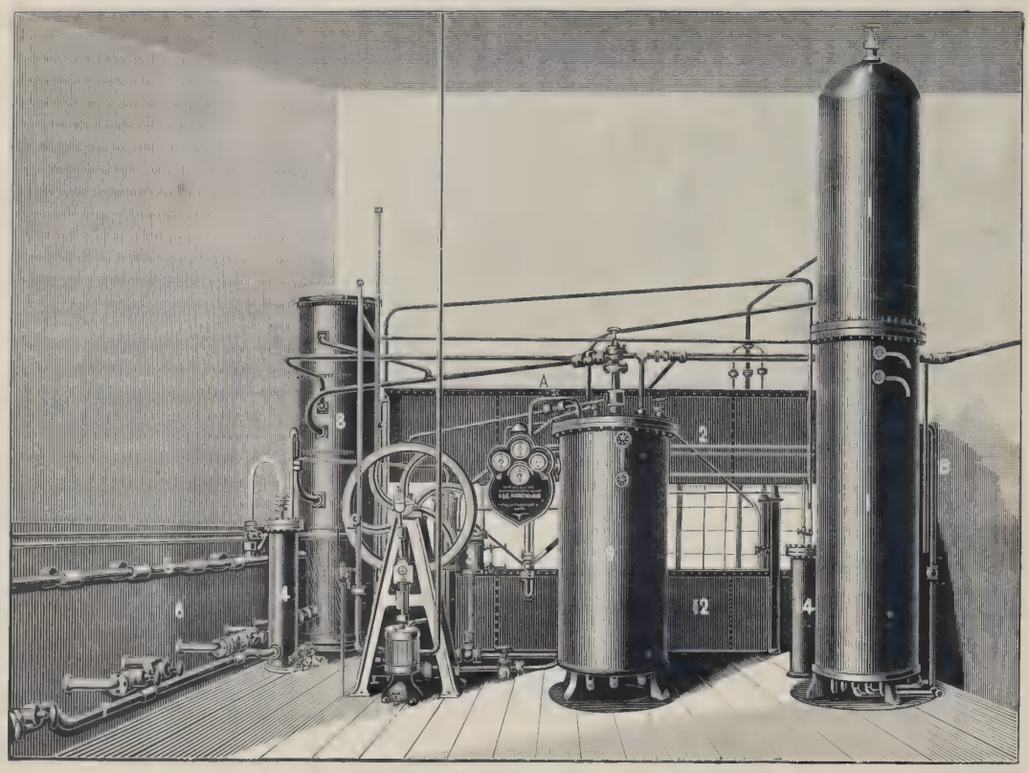
6. The Condensers and Freezers will not [illegible] and scale. They never require cleaning. They [illegible] and are not complicated by [illegible] tube attachments. Our freezing pots are manufactured [illegible] and are capable of low tests, and each pot is independent of the other. Each pot [illegible] can be taken out, while working without inconvenience with the other [illegible]

Company's Offices, 35 Broadway, Rooms 72, 73, 74 and 75, New York.

COLUMBUS IRON WORKS

IMPROVED

Absorption Ice Machine



SUCCESSORS TO
H. D. STRATTON & CO.

Established 1853.
Incorporated 1856.

W. R. BROWN, President.
W. COOK, Superintendent.

Machines from 5 to 33 tons capacity per 24 hours, or larger if desired.

94 Machines Built
and all in successful operation

More Ice Making Machines sold in the South than by any other establishment.

No expensive building required. No pressure on machine when stopped.

Send for price list and illustrated circular with location of machines.

This establishment was the first to turn out a perfect and complete Ice Machine, and has been in the business 21 years, constantly manufacturing and improving, and are prepared to furnish the most reliable and economical machine in the market.

BUILT BY THE . . . **COLUMBUS IRON WORKS CO.** COLUMBUS, GA.

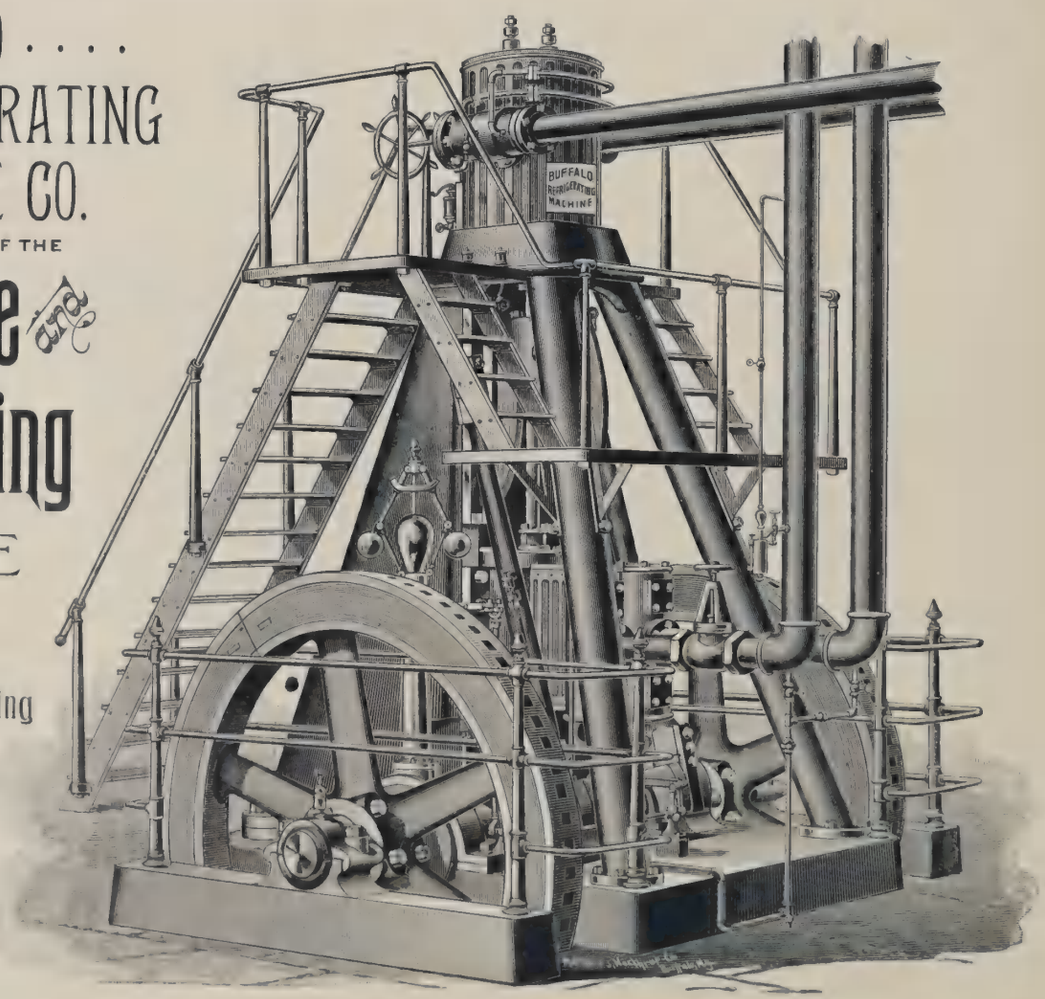
BUFFALO . . . . REFRIGERATING MACHINE CO.

BUILDERS OF THE

Buffalo Ice and Refrigerating MACHINE

For Ice Making and Artificial Refrigerating

Full particulars, Estimates, Illustrated Circular, containing list of machines in use, etc., furnished upon application.



Buffalo, N. Y.

The Improved Pontifex-Wood Machine

A MOST ECONOMICAL AND RELIABLE APPARATUS.

Adapted to all classes of Refrigeration, especially where extremely low temperatures are required.

ALSO FOR

MAKING . . . ICE

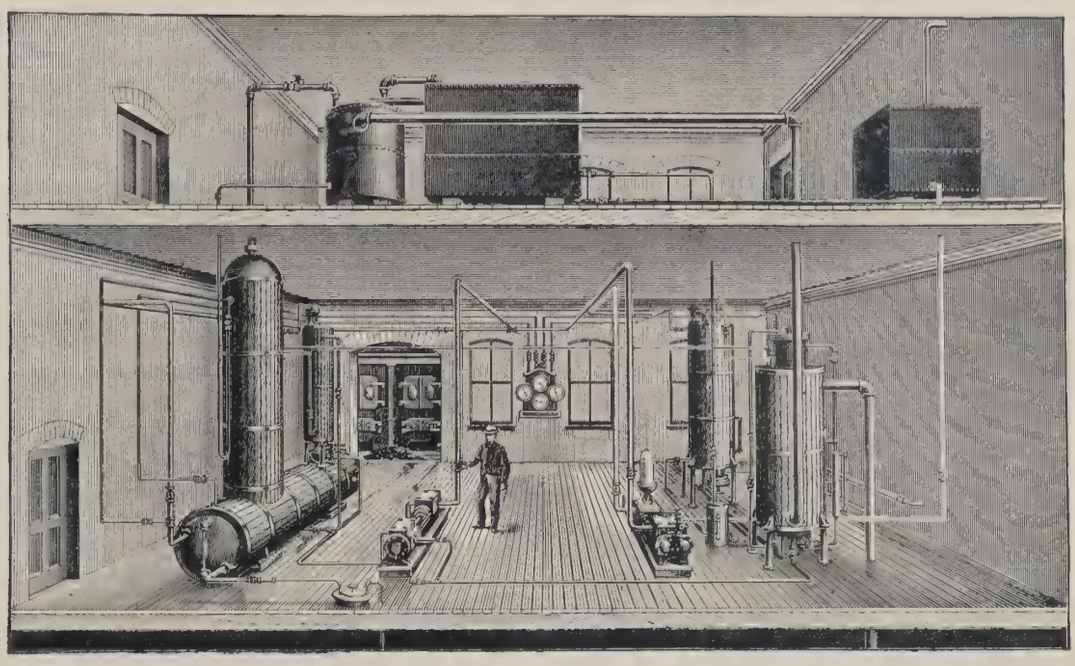
UPWARDS OF

400

MACHINES IN OPERATION.

H. J. W. S. COOKE,
Patentee.

ESTIMATES FURNISHED.
SEND FOR CIRCULARS.



ISBELL-PORTER COMPANY, BUILDERS,

OFFICES

245 BROADWAY, NEW YORK. 46 BRIDGE STREET, NEWARK, N. J.

THE RICHMOND ICE MACHINE CO.

MANUFACTURERS OF

THE

MOST IMPROVED

ON THE COMPRESSION PLAN.

Ice-Making and Refrigerating Machinery

A WORD IN YOUR EAR

OUR MACHINES ARE GIVING SATISFACTION AND MAKING THE GUARANTEED AMOUNT OF PURE, SOLID, TRANSPARENT ICE. . . . . .

We have undoubtedly the BEST and SIMPLEST Machine on the Market.

We guarantee the proper working of our machinery. All working parts built to gauge, so they can be readily duplicated, and nothing but the very best material used. Specifications and estimates furnished.

CORRESPONDENCE SOLICITED.

OFFICE, 1105 MAIN STREET,

WORKS . . . . .
MANCHESTER, VA.

P. O. BOX 315. **RICHMOND, VA.**

Send for our pamphlet "HOW TO MAKE AN ICE FACTORY PAY."

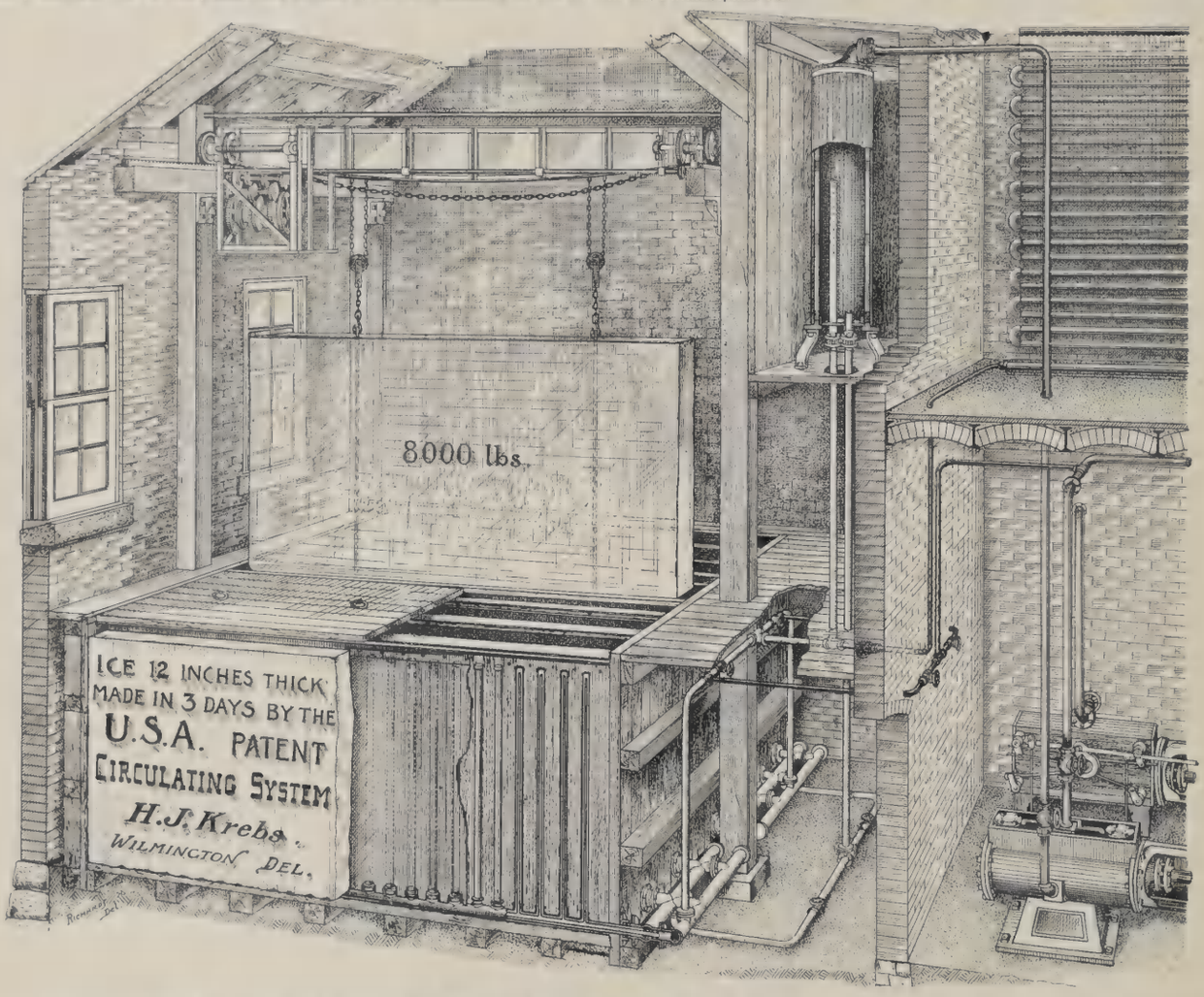
H. J. KREBS' U. S. A. Circulating System of Ammonia

PATENTED SEPTEMBER 9, 1890.

The results achieved by this system, both for brine cooling and ice making, are unexcelled. It ensures dry gas to the pump and abundance of feed to the expansion pipes, therefore economy in piping, economy in ammonia and economy in space. It is simple and easily operated, and saves time, money and worry.

IN ORDERING MACHINES SPECIFY THE U. S. A. CIRCULATING SYSTEM.

During last year it was introduced with great success in the following establishments: Charles W. Street, Packing House, Baltimore, Md.: Washington Abattoir Co., Bennings, D. C.: New Abattoir, Philadelphia Stock Yards, Philadelphia, Pa.: Wilmington Abattoir and Cold Storage Co., Wilmington, Del.: J. S. Bell & Sons, Ice Factory, Norfolk, Va. These plants were erected by Mr. J. C. Mustard, of 1818 N. 17th St., Philadelphia, Pa.



This system is suitable for all makes of Compression Machines. It secures ample feed to the expansion pipes and a regular flow of dry gas to the compressors, which thereby are enabled to do more and better work.

SOME OF THE ADVANTAGES ARE: Reduced number of valves, reduced pipe surface, reduced first cost, reduced consumption of ammonia, reduced attendance, reduced space, reduced wear and tear, reduced bills, increased refrigerating effect, increased certainty of operation, increased life of machinery, increased satisfaction, increased balance sheet. For full particulars address

H. J. KREBS, M. E., WILMINGTON, DEL.

J. C. MUSTARD,

1818 North 17th Street, Philadelphia, Pa.

BUILDER OF

ICE MAKING AND REFRIGERATING MACHINES

DURING LAST YEAR I HAVE ERECTED THE FOLLOWING PLANTS:

∴ REFRIGERATING . MACHINES ∴

N. Autle, Pork Packer,	Washington, D. C.	Big Elk Dairy,	Oxford, Pa.
C. Spuck, Sausage Maker,	Baltimore, Md.	West Chester Dairy,	West Chester, Pa.
David Eichner, Pork Packer,	Baltimore, Md.	Chas. W. Street, Packing House,	Baltimore, Md.
J. F. C. Hansen, Pork Packer,	Baltimore, Md.	Washington Abattoir Co.,	Bennings, D. C.
Jos. J. Martin, Brandywine Dairies,	Cossart, Pa.	Wilmington Abattoir and Cold Storage Co.,	Wilmington, Del.
R. W. Downing, Wallingford Dairy,	Wallingford, Pa.	New Abattoir, Philadelphia Stock Yards,	Philadelphia, Pa.
H. B. & E. A. Pugh, Dairy,	Oxford, Pa.		

∴ ICE . PLANTS ∴

J. S. Bell & Sons, Ice Factory,	Norfolk, Va.	Suffolk Ice Co.,	Suffolk, Va.

The last named plant I am now about starting, having changed it from absorption to compression. A number of above plants are fitted with the U. S. A. Circulating System, which for efficiency, economy, and simplicity cannot be surpassed. My long experience in the ice and refrigerating trade enables me to select the best, and I take especial pride in furnishing high grade machinery at moderate cost.

J. C. MUSTARD,

1818 North 17th St., Philadelphia, Pa.

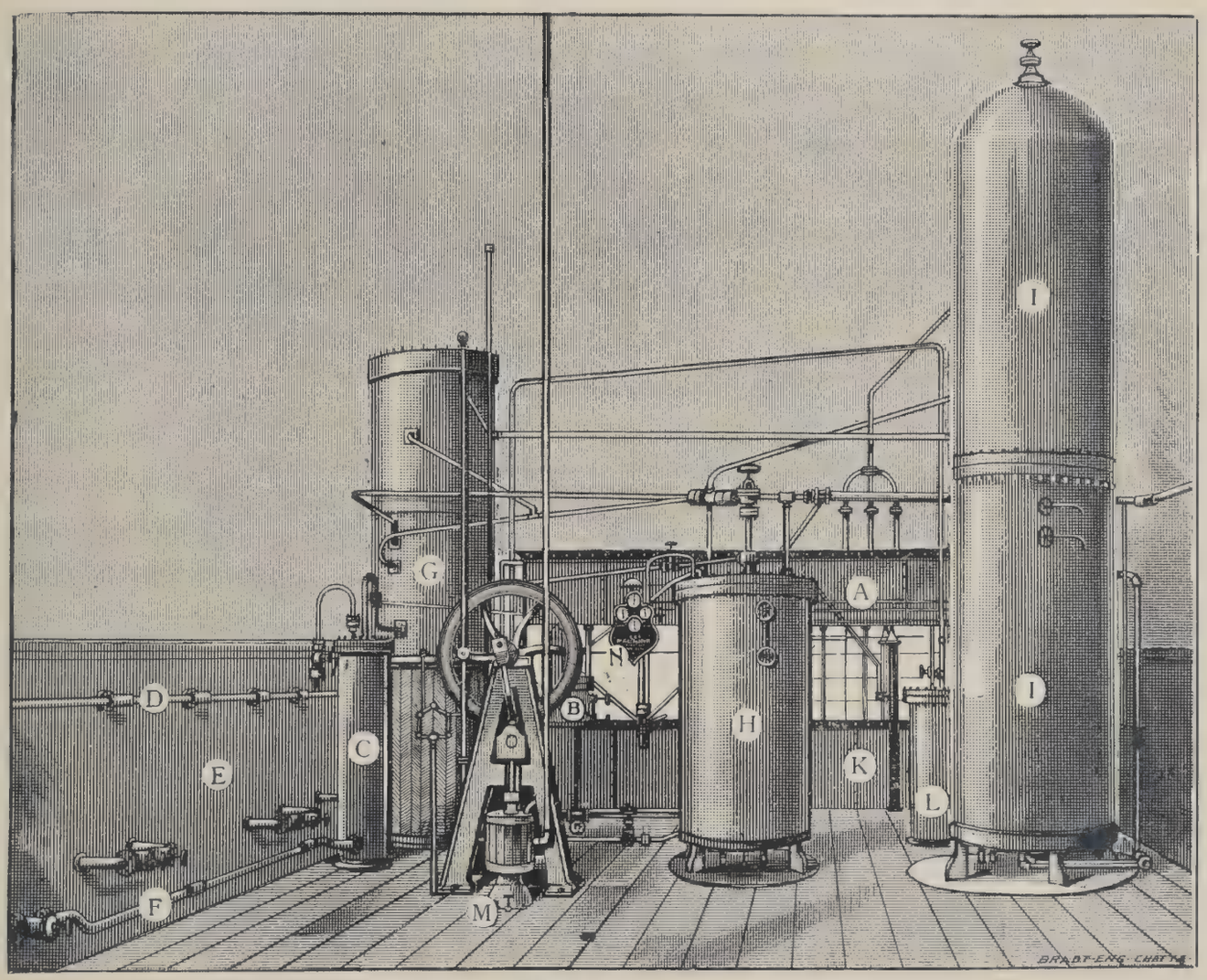
CORRESPONDENCE SOLICITED.

SOUTHERN ICE MACHINE CO.

SOLE OWNERS AND MANUFACTURERS OF

· · · The Latest Improved Absorption · · ·

ICE AND REFRIGERATING MACHINE.



∴ THE SOUTHERN ∴

The SOUTHERN ICE AND REFRIGERATING MACHINE is one of the best and has been acknowledged by the most experienced ice manufacturers to work more economical and produce ice cheaper and of a better quality than any other machine on the market to-day.

ALL MACHINES NOW IN OPERATION ARE GIVING PERFECT SATISFACTION.

FOR ESTIMATES AND FURTHER PARTICULARS ADDRESS THE . . . .

SOUTHERN ICE MACHINE CO.

CHATTANOOGA, TENN.

THE DE LA VERGNE REFRIGERATING MACHINE CO.

MANUFACTURERS OF

Foot of East 138th Street (Port Morris.)

NEW YORK, U. S. A.

REFRIGERATING AND ICE MACHINES AND ANHYDROUS AMMONIA . . . .

Over

360

Machines are now in Successful Operation, Representing a Total Capacity Equal to the Melting of over

18.000

Tons of Ice Per day.



Machines are used for the Cooling of

Breweries, Abattoirs and Packing Houses, Markets and Cold Storage, Hotels and Restaurants, Chemical Works, Confectioneries, and Chocolate Manufactories, Steamship Holds, Wineries, Dairies,

AND FOR THE MANUFACTURE OF ICE

A FULL DESCRIPTION OF OUR SYSTEM AND APPARATUS WILL BE SENT TO PERSONS APPLYING FOR THE SAME.

CORRESPONDENCE FROM PARTIES DESIROUS OF CONTRACTING FOR PLANS IS SOLICITED.

Estimates and Proposals will be promptly furnished free of charge as soon as the requirements are made known to us.

PICTET

Ice and Refrigerating Machine

....MANUFACTURED BY....

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

WE DO NOT USE AMMONIA.

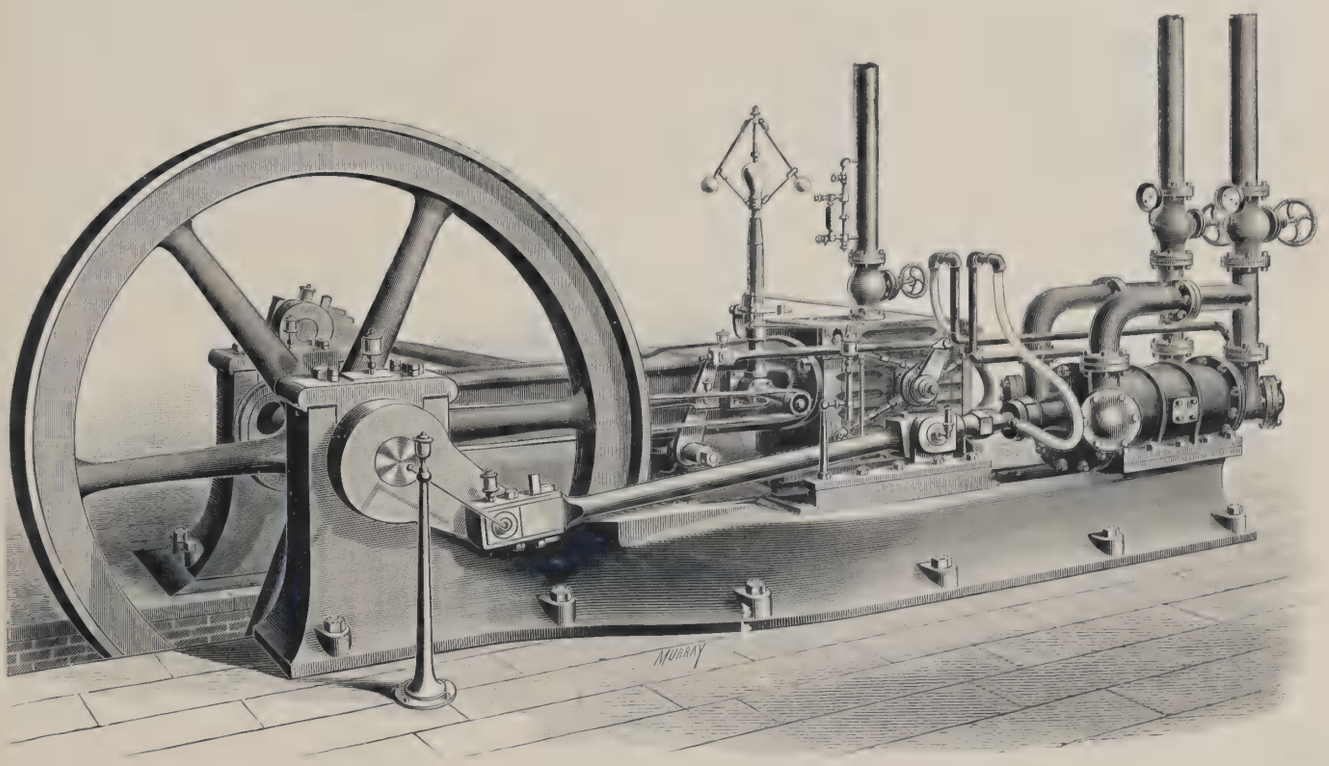
Pictet Machines use **Anhydrous Sulphurous Oxide,** a chemical noted for its low working pressure, is of itself a lubricant, and does not injure any of the metals; its low pressure is a guarantee against explosion.

NEW YORK BOARD OF FIRE UNDERWRITERS.
BUREAU OF SURVEYS
JAMES HARRISON, Supt.
Boreel Building, 115 Broadway, Room 37.

NEW YORK, January 21, 1891.

THE PICTET ARTIFICIAL ICE CO. (Limited), New York:

Dear Sirs: Your favor of the 22d inst. is at hand. In reply, the examination of our expert and his subsequent report were convincing that the article known as Anhydrous Sulphurous Oxide is a safe article for storage or shipment, its tendency being to extinguish rather than to cause fire. Yours truly, JAMES HARRISON, Supt.



Working Pressure from 50 to 75 lbs.

We guarantee GREATER ECONOMY OF FUEL, doing the same amount of work with less coal than any machine in the market.

FOR LIST OF REFERENCES AND FURTHER PARTICULARS, ADDRESS

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

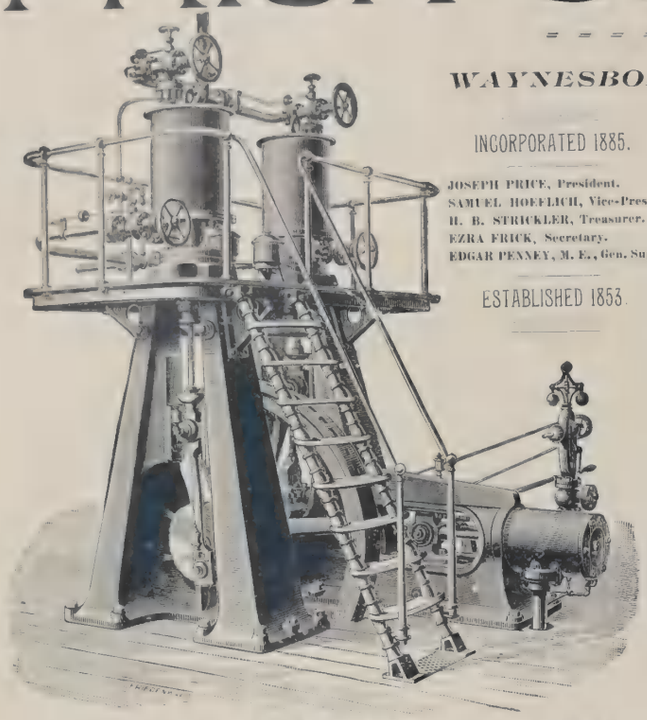
WORKS: NEWBURGH, N. Y.

New York Office, 21 Cortlandt St., Room 6.

FRICK COMPANY

ENGINEERS,

WAYNESBORO, FRANKLIN COUNTY, PA., U. S. A.



3-Ton Machine.

INCORPORATED 1885.

JOSEPH PRICE, President.
SAMUEL HOEFLICH, Vice-Pres.
H. B. STRICKLER, Treasurer.
EZRA FRICK, Secretary.
EDGAR PENNEY, M. E., Gen. Sup.

ESTABLISHED 1853.



MAIN WORKS AND GENERAL OFFICES: WAYNESBORO, PA.

CAPITAL, - - - - - - $1,000,000.

MANUFACTURERS OF THE

ECLIPSE

Ice Making AND Refrigerating Machines.

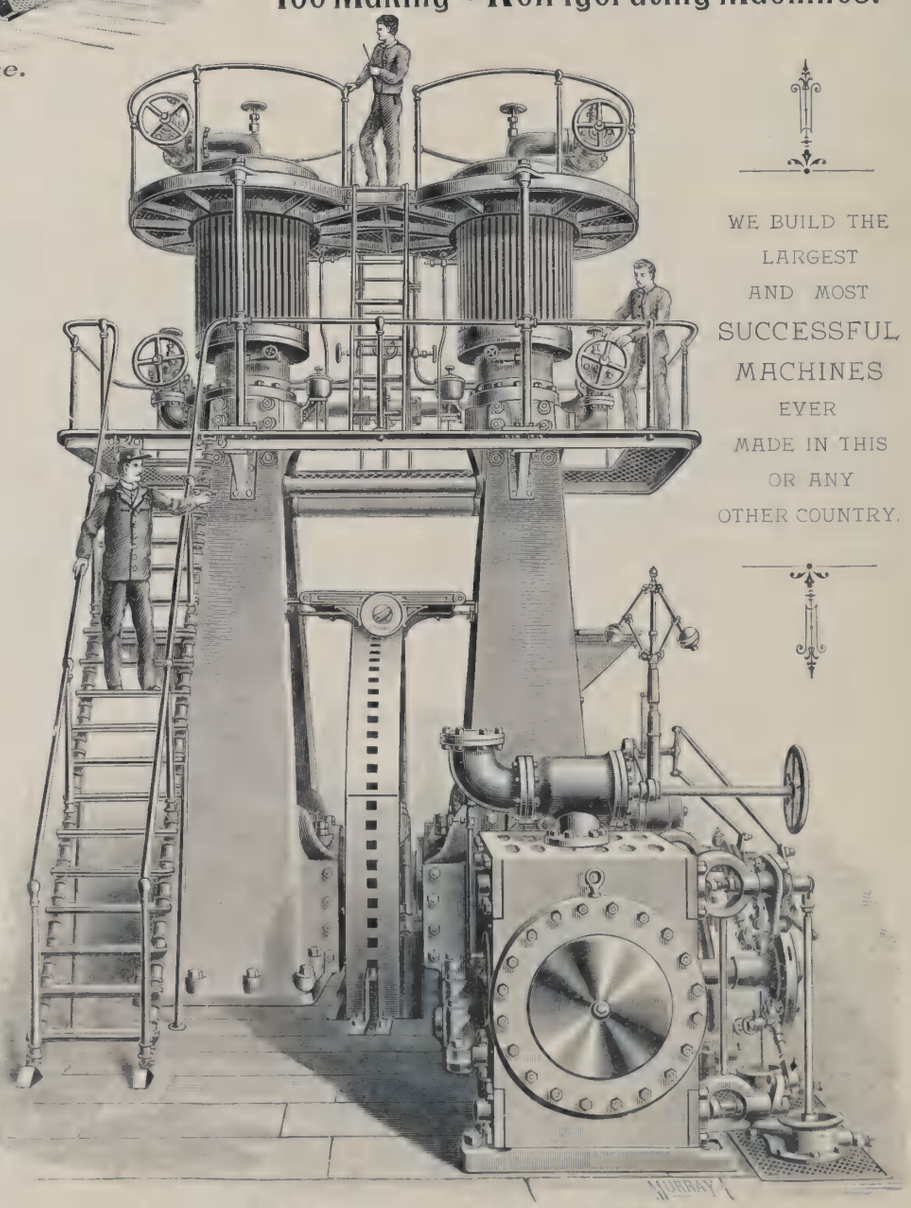
SEND FOR OUR NEW CATALOGUE, 1890.

A Few References:

BREWERIES.	Refrigerating Tons.
Phoenix Brg. Co., Baltimore, Md.	27
Gupps Brg. Co., Peoria, Ill.	50
Sprattler & Mennell, Paterson, N. J.	32
Herman Lackman, Cincinnati.	65
Henry Fink, Harrisburg, Pa.	32
Sebastian Helldorfer, Baltimore, Md.	32
Frank Reisch & Bros., Springfield, Ill.	50
Jos. Stein & Co., Louisville, Ky.	23
Meyer & Reidlin, Covington, Ky.	32
Parkersburg Brg. Co., Parkersburg, W. Va.	27
Bellevue Brg. Co., Cincinnati, O.	50
Cumberland Brg. Co., Cumberland, Md.	27
D. Lutz & Son, Allegheny, Pa.	50
Herman Lackman, Cincinnati (2d order)	80

PACKING AND COLD STORAGE.	
J. C. Shafer & Co., Baltimore	40
G. Cassard & Sons, Baltimore	25
Baltimore City Storage Co., Baltimore	32
Armour Packing Co., Kansas City	100
Shallcross & Son, Coatesville, Pa.	15
Washington Market Co., Washington, D. C.	32
Armour Pckg. Co., Kansas City (2d order)	150
Francis Whittaker & Sons, Wichita, Kas	150
Emil Winters, Pittsburgh, Pa.	37
Frank Seffrid, Louisville, Ky.	7
Chicago Packing & Provision Co., Chicago	150
Chicago Packing & Provision Co., Chicago (second order)	150
Steelton Store Co., Steelton, Pa.	10
Pittsb'gh Meat Supply Co., Allegheny, Pa.	50
J. Vogle & Son, Cincinnati	50
John C. Hately, Chicago	65
G. H. Hammond & Co., Hammond, Ind.	150
G. H. Hammond & Co., Omaha, Neb	150
Calumet Canning Co., Hammond, Ind.	32
West Chester Cd. Stor. Co., W. Chester, Pa.	40
Chautauqua Lake Ice Co., Pittsburgh, Pa.	20

ICE FACTORIES.	Ice. Tons.
F. L. Ellis & Co., Hopkinsville, Ky.	10
Consumers Ice Co., New Orleans, La.	100
Little Rock Ice Co., Little Rock, Ark.	35
Consumers Ice & Cd. Stor. Co., O'sh'o, Ky	20
W. S. Lacey, Jacksonville, Ill.	15
Paducah Ice Co., Paducah, Tenn.	5
Armour Pckg. Co., Kansas City	75
Ewing & Beall, Uniontown, Pa.	15
S. W. Hall, Allegheny, Pa.	18
Chautauqua Lake Ice Co., Pittsburgh.	40
Chautauqua Lake Ice Co., Pittsburgh (2d order)	40
West Chester Ice Co., West Chester, Pa.	15
Steelton Store Co., Steelton, Pa	2
Parkersburg Brg. Co., Parkersburg W. Va.	3
Cumberland Brg. Co., Cumberland, Md.	8
Hagerstown Ice Co., Hagerstown, Md.	20
Alberto Malo, City of Mexico, Mex.	25
Germantown Ice Co., Germantown, Pa.	20
Bryn Mawr Hotel Co., Bryn Mawr, Pa.	20
Geo. S. Sexton & Co., Wytheville, Va.	5
Cambridge Ice Co., Cambridge, Md.	10

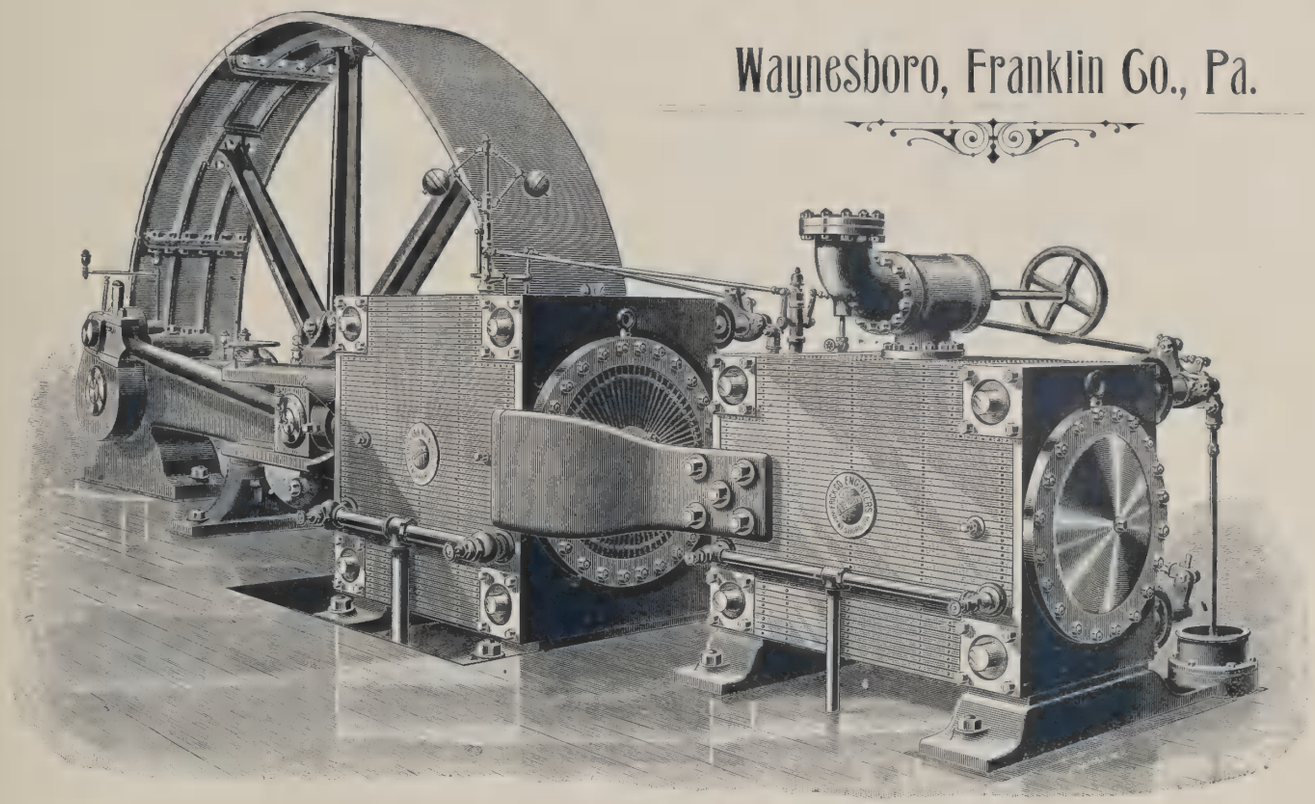


150-Ton Machine. Weight, 193,250 Pounds.

WE BUILD THE LARGEST AND MOST SUCCESSFUL MACHINES EVER MADE IN THIS OR ANY OTHER COUNTRY.

FRICK COMPANY, ENGINEERS,

Waynesboro, Franklin Co., Pa.



A GENUINE CORLISS ENGINE WITH ALL THE LATEST IMPROVEMENTS.

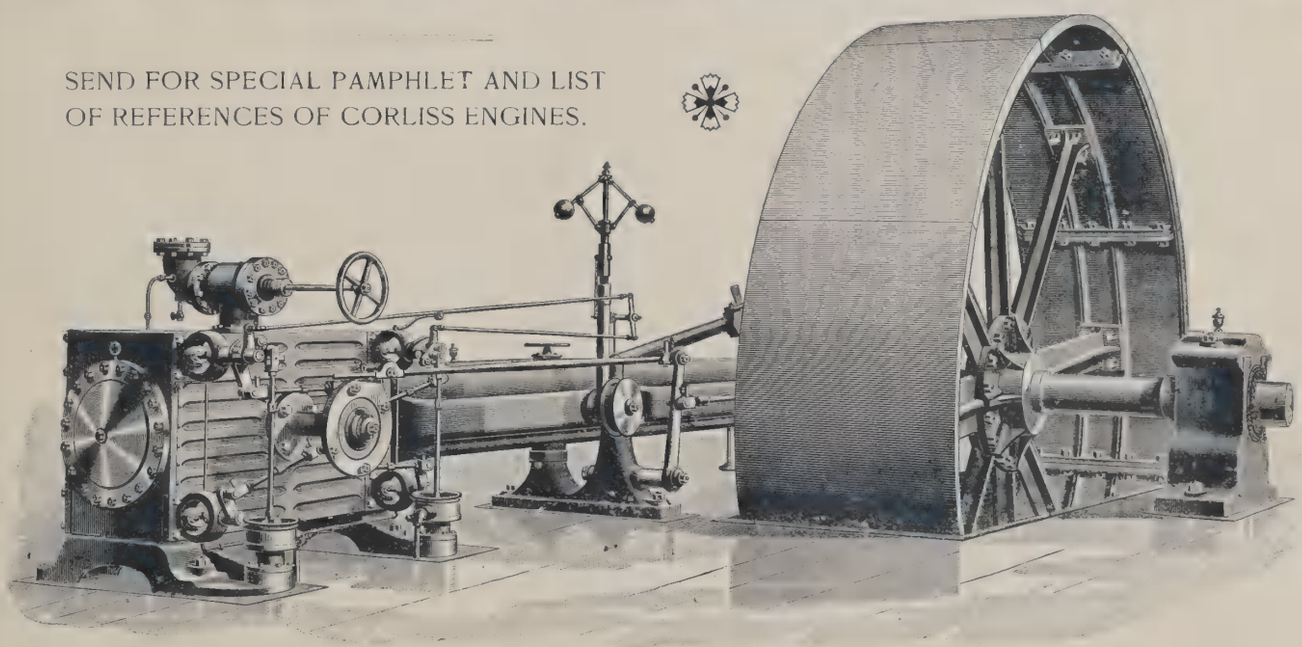
"EGLIPSE" CORLISS TANDEM COMPOUND CONDENSING ENGINE

UP TO 3000 HORSE POWER

We have complete line of patterns and build Corliss Horizontal Stationary Engines, Corliss Vertical Engines, Condensing or Non-Condensing, Single or in Pairs. Corliss Compound Engines, Tandem or Cross Compound. Corliss Engines for any service, 40 to 3000 horse power, in a single engine.

SPECIAL NOTICE.—With our Corliss Engine we contract for fitting up complete the entire Steam Plants, including Steam Boiler, Feed Water Heater, Feed Pumps, Piping, Shafting, and all the appurtenances and belongings peculiar to a first-class job.

SEND FOR SPECIAL PAMPHLET AND LIST OF REFERENCES OF CORLISS ENGINES.



1000 HORSE POWER "EGLIPSE" PLAIN CORLISS ENGINE.

THE WILSON-SNYDER MFG. CO.

MANUFACTURERS OF AUGUST SNYDER'S PATENT

Ice and Refrigerating Machine

SPECIALLY DESIGNED TO MEET THE DEMANDS OF ICE MAKERS AND REFRIGERATION IN ALL ITS APPLICATIONS . . . . . .



INTERIOR VIEW OF WORKS OF THE WILSON-SNYDER MFG. CO.

TWO styles of these machines are built: One, single acting compressor, with duplex condensers and brine tanks; the other, duplex compressor, condensers and brine tanks. The special advantages of this machine over all others are as follows: In either the single or duplex machine, either one of the brine tanks or condensers getting out of order, or anything happening to necessitate repair, the system of valves is so arranged as to allow using but one condenser or one brine tank, and the machine is kept running with the disabled part as though nothing had happened, while the disabled brine tank or condenser is being dismantled and repaired. Write for list of machines in operation, references, prices, etc. . . . . .

ALSO MANUFACTURERS OF IMPROVED . . . .

PUMPING MACHINERY

Including AIR PUMPS, BRINE PUMPS, HOT AND COLD WATER PUMPS, BOILER FEED PUMPS, TANK PUMPS, Etc.

Ammonia Valves, Pipe Coils and Pipe Fittings

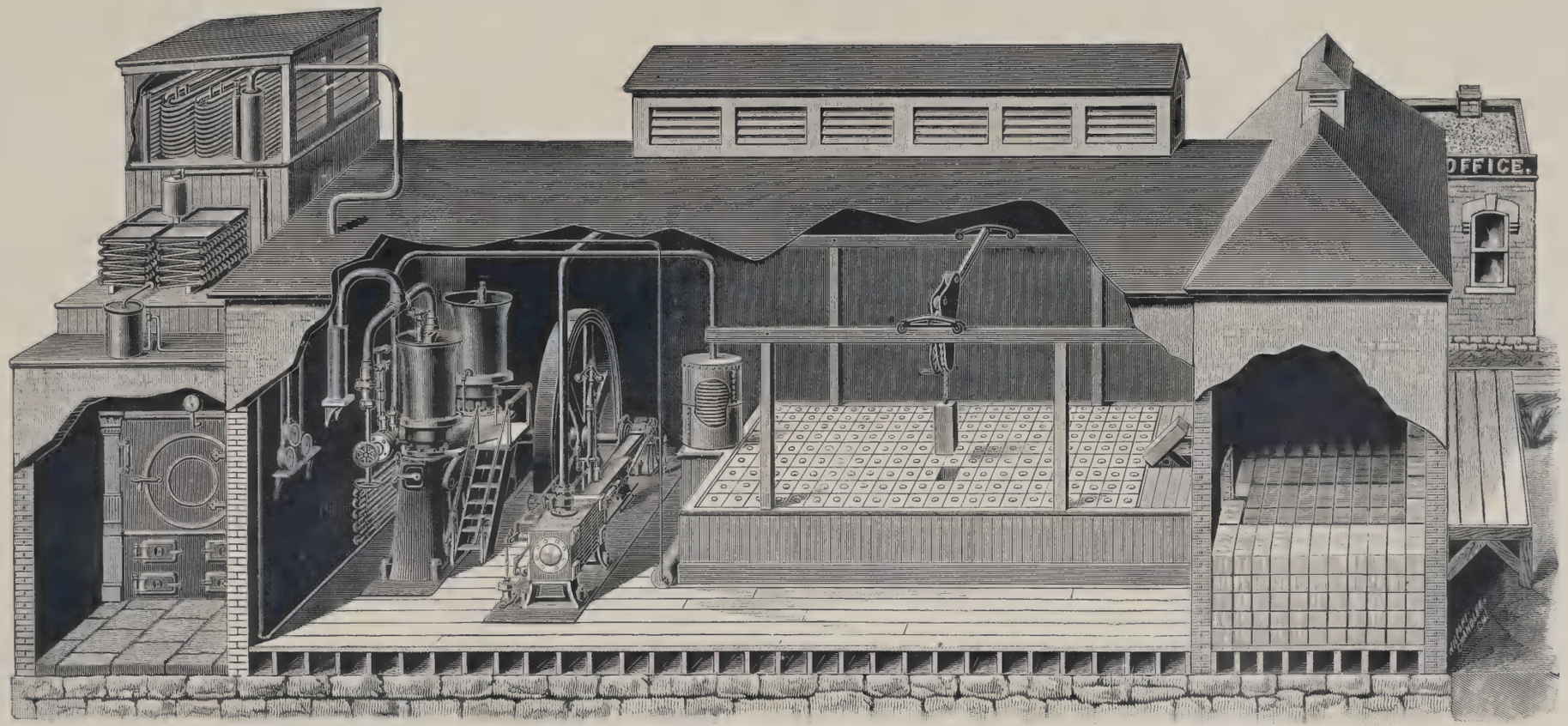
.....OF EVERY DESCRIPTION.....

PITTSBURGH, PA.

HERCULES ICE AND REFRIGERATING MACHINE

(REFRIGERANT: ANHYDROUS AMMONIA.)

For Breweries, Packing Houses, Cold Storage,



A MODEL ICE PLANT.

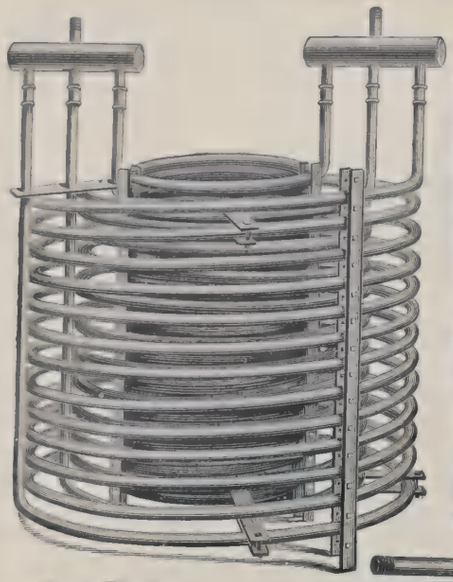
ARTIFICIAL ICE PLANTS

STRONGEST, MOST DURABLE AND MOST ECONOMICAL MACHINE ON THE MARKET. OUR GUARANTEE IS THE HIGHEST GIVEN BY ANY COMPANY, AND EVERY MACHINE SOLD HAS EXCEEDED THE GUARANTEE. SEND FOR ILLUSTRATED CIRCULAR AND REFERENCES.

WORKS, AURORA, ILL.

THE HERCULES IRON WORKS, CHICAGO.

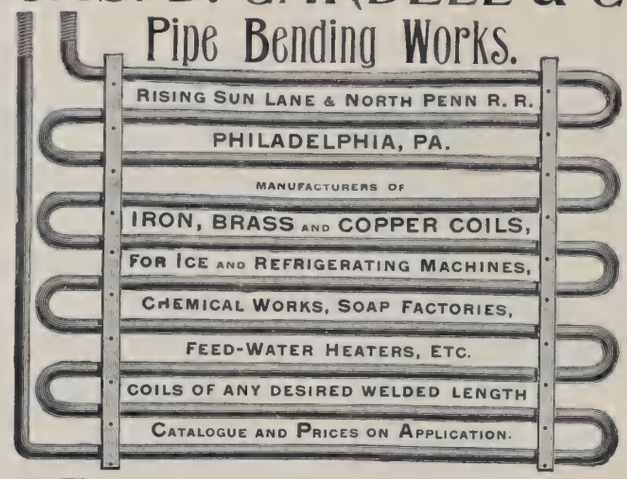
ROOM 502 OWINGS BUILDING,
DEARBORN AND ADAMS STS.



JAMES D. CARDELL. WASHINGTON HOPKINS.

JAS. D. CARDELL & CO.

Pipe Bending Works.



RISING SUN LANE & NORTH PENN R. R.

PHILADELPHIA, PA.

MANUFACTURERS OF

IRON, BRASS AND COPPER COILS,

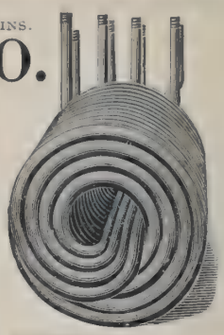
FOR ICE AND REFRIGERATING MACHINES,

CHEMICAL WORKS, SOAP FACTORIES,

FEED-WATER HEATERS, ETC.

COILS OF ANY DESIRED WELDED LENGTH

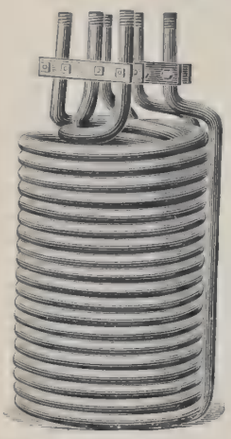
CATALOGUE AND PRICES ON APPLICATION.



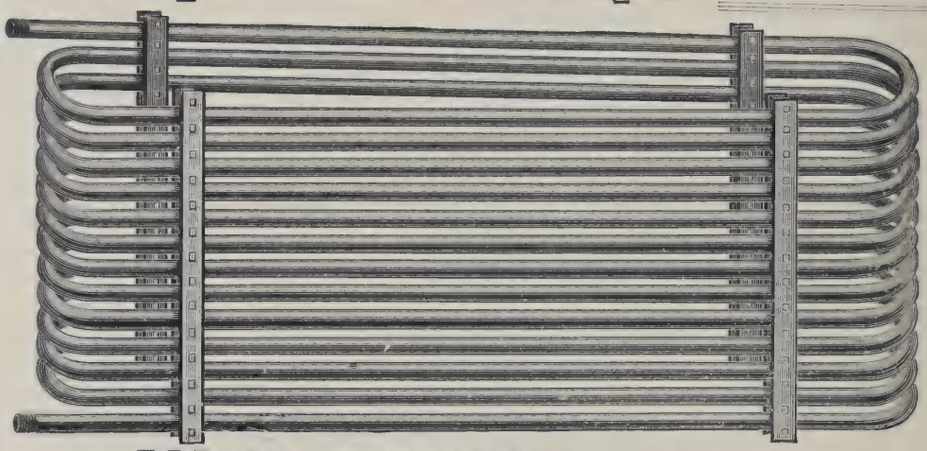
BENDING @

Of Large Sizes Pipe a specialty

SEND FOR CATALOGUE.



Brine and Condenser Tanks, Ammonia Bottles, Ammonia Valves, Flanges, ETC.



JAMES D. CARDELL & CO.



Practical, not Theoretical . . . Over 15,000 in daily use.

ON THE MARKET SINCE 1884.

Did You Ever Stop

to think what it means to have the water carried uniformly at the proper level?

IT MEANS safety, saving of fuel, steady power, and more of it, no leaky tubes, no burned boilers, no stoppage for expensive repairs.

ALL of which

YOU CAN secure for merely nominal cost,

BY USING

INCLUDE THEM IN ALL BOILER SPECIFICATIONS.

Send for Price List.

For Sale Everywhere.

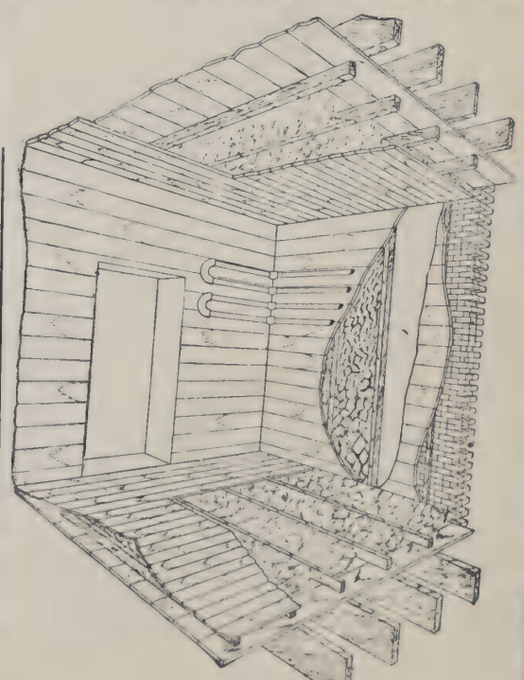
The Reliance Safety Water Columns.

THE RELIANCE GAUGE CO.

101 EUCLID AVE., CLEVELAND, O.

MINERAL WOOL

GOLD STORAGE, BREWERIES



INSULATION

ICE PLANTS REFRIGERATORS.

FOR FREE SAMPLE AND BOOK, ADDRESS

Western Mineral Wool Co.

CHICAGO. CLEVELAND. ST. LOUIS.

Write for Prices on the . . . . . .

CORRUGATED... ... WATER-TUBE **FEED-WATER HEATER**

More Effective and Durable . . . . . .

Than a Coil Heater at the Same Price.

SOLE MANUFACTURERS:

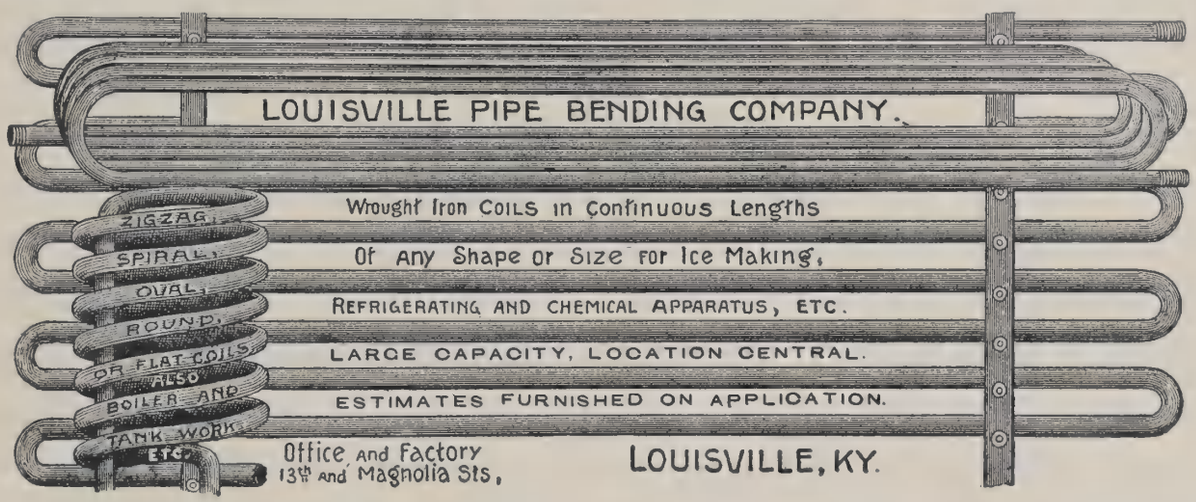
The Wainwright Manufacturing Co. of Mass.

8 Oliver Street, BOSTON.

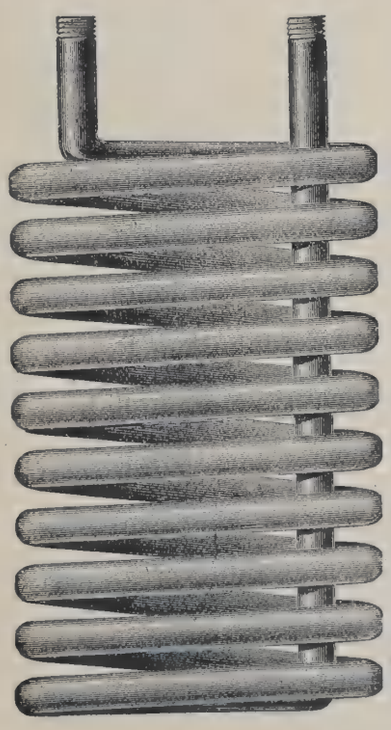
SEND FOR CATALOGUE I. C.

CHICAGO: 26 West Randolph Street.

NEW YORK: 121 Liberty Street.



THE HARRISBURG PIPE BENDING CO. LIMITED.



WORKS, S. E. CORNER HERR STREET AND PENNSYLVANIA CANAL. HARRISBURG, PA.

.....MANUFACTURERS OF.....

COILS AND BENDS

Of Wrought Iron Pipe . . For Ice Making and Refrigerating

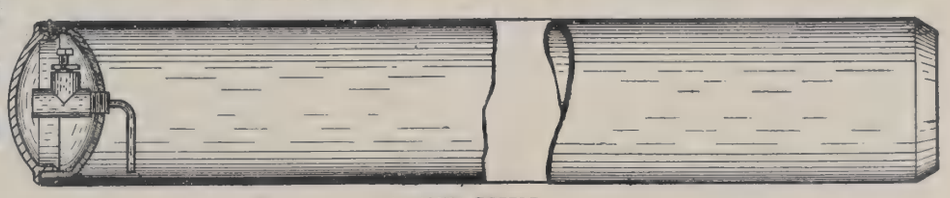
in Round, Oval, Zigzag, Spiral, Helical and Tapering Forms.

CHEMICAL WORKS, FEED-WATER HEATERS,

BLAST FURNACES, EVAPORATING LIQUIDS,

AMMONIA MACHINES, SOAP WORKS, ETC.

IRREGULAR PIPE BENDING A SPECIALTY



AMMONIA BOTTLE.

AMMONIA . BOTTLES . OR . FLASKS . WITH . WELDED . HEADS

STRAIGHT OR CONCAVE

New York Coal Tar Chemical Co.

10 WARREN ST., NEW YORK.

MANUFACTURERS OF

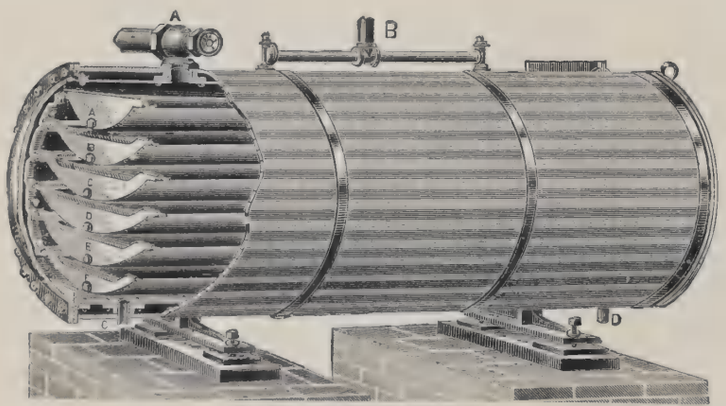
ABSOLUTELY PURE

ANHYDROUS AMMONIA

AND

AQUA AMMONIA

FOR REFRIGERATING PURPOSES.



HOPPES LIVE STEAM PURIFIER.

THE

"HOPPES"

Live Steam Feed-Water

PURIFIER

Is especially adapted to ICE MAKING PLANTS, as pure water is essential to insure a good quality of ICE. The use of the HOPPES PURIFIER will insure you pure water, by removing all of the impurities therefrom, at the same time keeping your boilers clean and free from scale without the use of boiler compounds or scale solvents.

CATALOGUES, ESTIMATES, SPECIFICATIONS, ETC., CHEERFULLY FURNISHED.

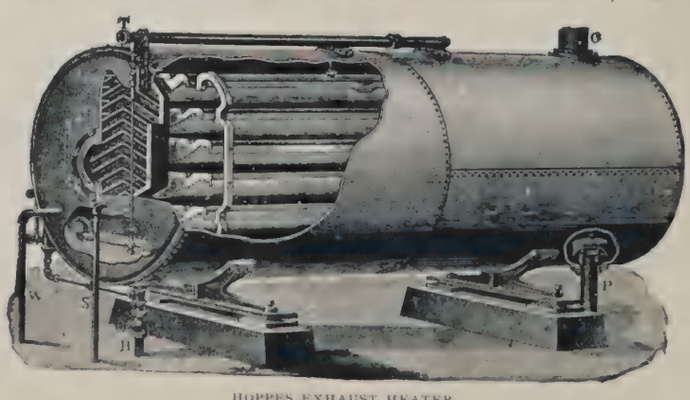
THE HOPPES MFG. CO., SPRINGFIELD, O.

IF YOU WANT TO GET THE FULL BENEFIT OF YOUR EXHAUST STEAM, INVESTIGATE THE

"HOPPES"

Exhaust Steam Feed-Water

HEATER



HOPPES EXHAUST HEATER

The National Ammonia Co.

... ABSOLUTELY DRY AND PURE ...

Our Ammonias are the Recognized Standards of Quality. Use Our Brands and Secure the Best Results with your Machines.

LIQUID ANHYDROUS AMMONIA AND AQUA AMMONIA (ALL STRENGTHS),

For Refrigerating and Ice Machines.

GENERAL OFFICES:--ST. LOUIS, MO.

We are the Largest Manufacturers in the World. Send your Orders to Us and Get Prompt and Satisfactory Service.

Our Ammonia can be had of the following Agents:

NEW YORK—The De La Vergne Refrig. M. Co.
W. M. Schwenker.
Mallinckrodt Chemical Works.
PHILADELPHIA—Theo. J. Goldschmid.
BALTIMORE—Wm. Mitchell.
WILMINGTON—Delaware Chemical Co.
BUFFALO—Kast Copper & Sheet Iron Co.
ST. LOUIS—Mallinckrodt Chemical Works.
Larkin & Scheffer.
CINCINNATI—Herman Goepper & Co.
CLEVELAND—Benton, Myers & Co.
DETROIT—Michigan Ammonia Works.
KANSAS CITY—Henry Menderson.
CHICAGO—A. Magnus' Sons.
Fuller & Fuller Company.
MILWAUKEE—The Chas. Baumbach Company.
SAN FRANCISCO—Herrmann & Company.
PORTLAND, ORE.—Snell, Heitschu & Woodard.

B. P. CLAPP AMMONIA COMPANY,

MANUFACTURERS OF

ABSOLUTELY PURE - - 26° AQUA AMMONIA

Containing 29¼ per cent of Ammonia.

FOR REFRIGERATING PURPOSES AND THE TRADE . . . . . .

GENERAL OFFICES

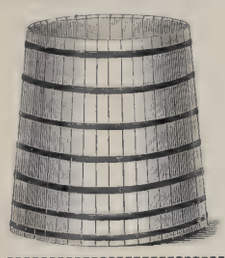
245 BROADWAY, NEW YORK.

THE CLEVELAND ANHYDROUS AMMONIA WORKS

THOS. FLESHER, JR., Proprietor.

MANUFACTURERS OF ...PURE... Anhydrous Ammonia.

70 E. Prospect St., CLEVELAND, OHIO.



GEO. WOOLFORD,

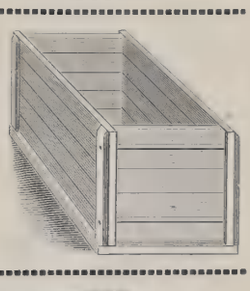
Manufacturer of all kinds of

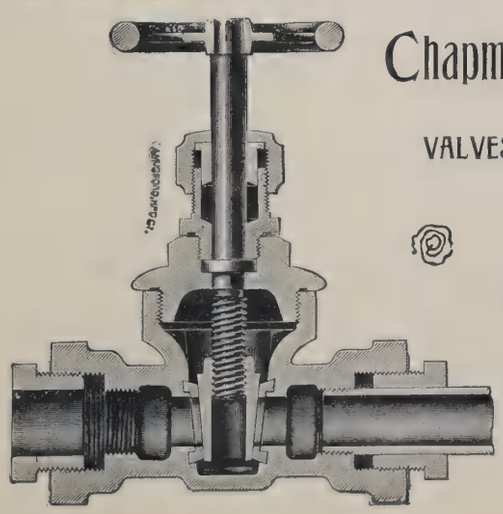
Cedar Vats, Tanks, HOT & COLD Water Tanks, Railroad Tanks

In sending for estimates, state if measurements are inside or outside, and thickness of wood desired . . . . . .

FOR ICE FACTORIES, COLD STORAGE HOUSES RAILROADS, PACKERS, CHEMICAL WORKS, ETC.

2240, 2242 and 2244 North 9th Street, PHILADELPHIA.





Chapman Valve Manufacturing Co.

.....MANUFACTURERS OF.....

VALVES AND GATES FOR WATER, GAS, STEAM, ACID, OIL, AMMONIA, ETC.

ALSO GATE FIRE HYDRANTS

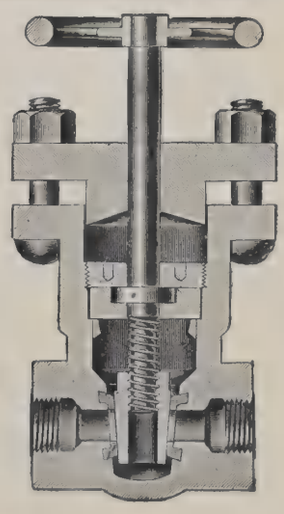
SPECIAL ATTENTION GIVEN TO

VALVES FOR REFRIGERATING, COLD STORAGE, ICE MAKING MACHINERY, ETC.

We make the best Valve for Ammonia Heavy Pressure in the market. The two illustrations here represent Ammonia Valves that are giving universal satisfaction.

General Office and Works, INDIAN ORCHARD, MASS

Treasurer's Office, 72 Kilby and 112 Milk Sts. BOSTON, MASS.



THE LAIDLAW & DUNN CO.

PURCHASERS OF { McGOWAN PUMP CO. / ECLIPSE PUMP MFG. CO.

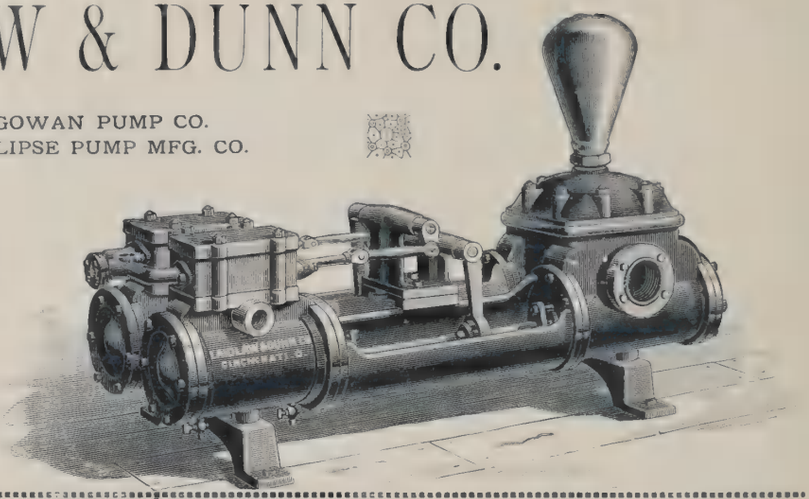
MANUFACTURERS OF

BRINE
WATER
BREWERY

PUMPS

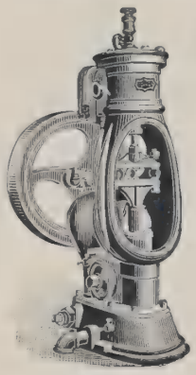
AND PUMPS FOR ALL PURPOSES.

CINCINNATI, OHIO.



AMMONIAL LIQUID . . . .

PUMPS



FOR USE IN.....

ICE MAKING AND REFRIGERATING PLANTS

These Pumps are made very heavy and guaranteed to work smoothly against 300 pounds pressure to the square inch . . . . . .

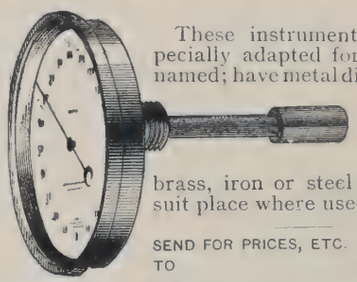
VALLEY PUMP CO.

EASTHAMPTON, MASS.

Standard Thermometers.

FOR USE IN

Ice Machines,
Refrigerators,
Brine Tanks,
Ammonia
Circulating Pipes,
Etc., Etc.



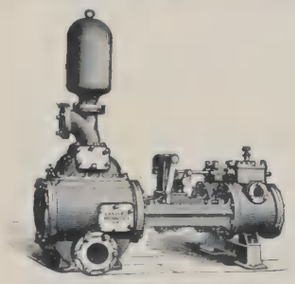
These instruments are especially adapted for purposes named; have metal dials, either brass, iron or steel casing to suit place where used.

SEND FOR PRICES, ETC. TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Cortlandt St. Boston Office, 70 Pearl St.



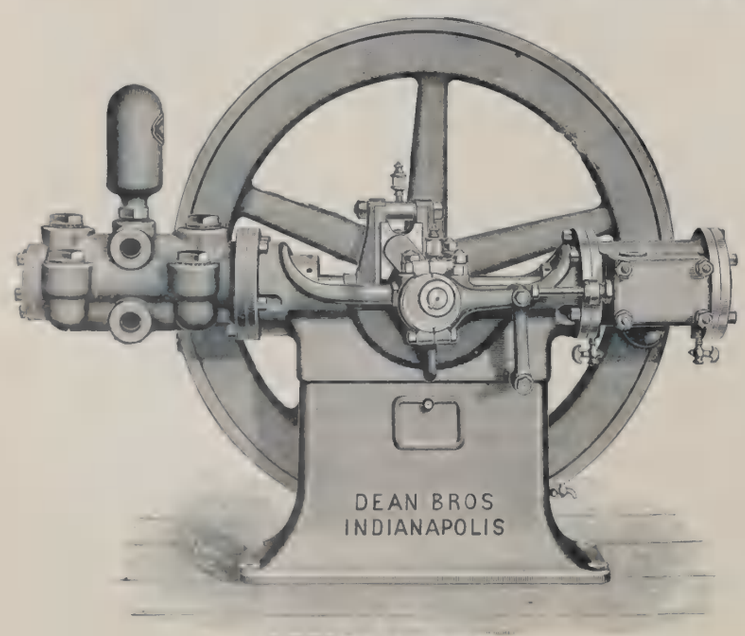
DUPLEX WATER SUPPLY PUMP.

DEAN BROS.

Steam Pump Works

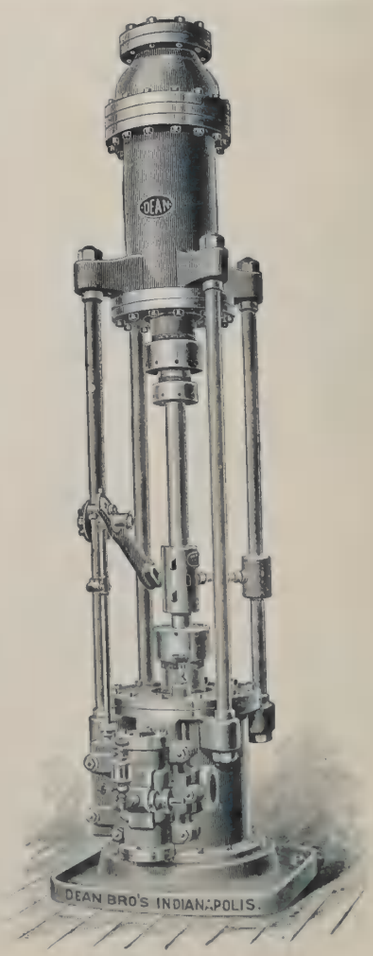
INDIANAPOLIS, IND.

BOILER FEEDERS, BRINE PUMPS,
DEEP WELL PUMPS, SINGLE AND DUPLEX PUMPS.



HORIZONTAL AMMONIA PUMP.

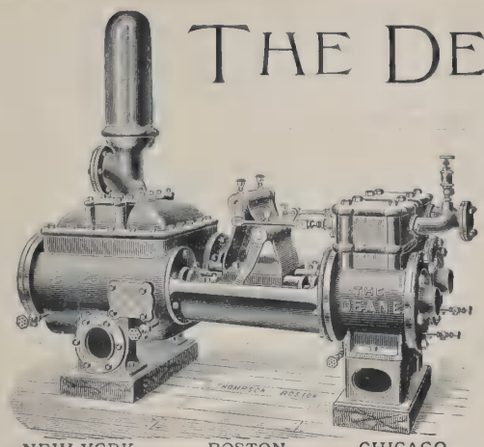
SEND FOR CATALOGUE



VERTICAL AMMONIA PUMP

THE DEANE STEAM PUMP CO.

HOLYOKE, MASS.



STEAM PUMPS

FOR EVERY SERVICE.

AMMONIA PUMPS,
BRINE PUMPS,
TANK PUMPS, ETC.

For Ice Manufacturing Machinery

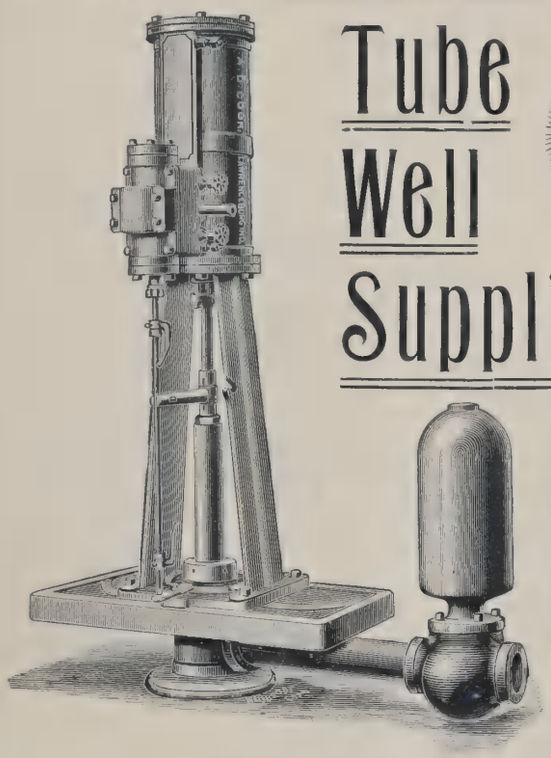
For full information and Illustrated Catalogue, write . . . . . .

NEW YORK BOSTON CHICAGO.
PHILADELPHIA. ST. LOUIS. DENVER.

DEANE STEAM PUMP CO., Holyoke, Mass.

A. D. COOK

.....MANUFACTURER OF IMPROVED.....



Tube Well Supplies

Cook's
Patent
Tube
Well
Strainers

.....AND.....

STEAM PUMPS ...A... SPECIALTY

LAWRENCEBURG, IND.

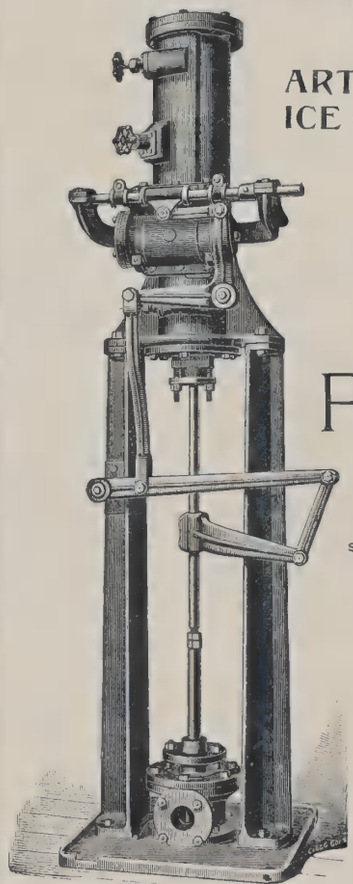
EPPING Pump

. . . DEEP-WELL

....FOR....

ARTIFICIAL ICE COMPANIES

BREWERIES and COLD STORAGE WAREHOUSES



PUMPS

For all Purposes.

SEND FOR CATALOGUE TO

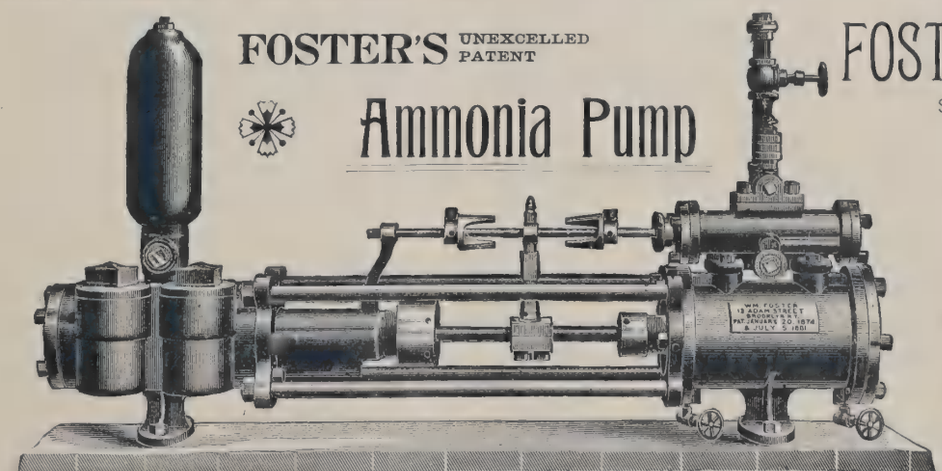
EPPING, CARPENTER & CO. LIMITED,

2410-2420 Penn Ave.,

PITTSBURGH, PA.

FOSTER'S UNEXCELLED PATENT

Ammonia Pump



FOSTER PUMP WORKS

Successors to WILLIAM FOSTER

MANUFACTURERS OF

PATENT IMPROVED

STEAM PUMPS

FOSTER'S EXCELSIOR ROTARY PUMPS,

Beer and Mash, Boiler Feed, Tank, Air, Deep Well and Artesian Well Pumps.

36 AND 38 BRIDGE ST. BROOKLYN, N.Y.

ing-box is carried back into the suction again. It has extra hard steel Piston Rod, which is made in two sections, so as to be easily replaced when ammonia part of piston rod is worn out, and without necessitating the removal of the steam portion of rod.

The advantages of this Pump are, its extra long double stuffing-box, which is so arranged that any leakage from first stuff-

HERF & FRERICHS CHEMICAL CO.

ST. LOUIS, MO.

MANUFACTURERS OF

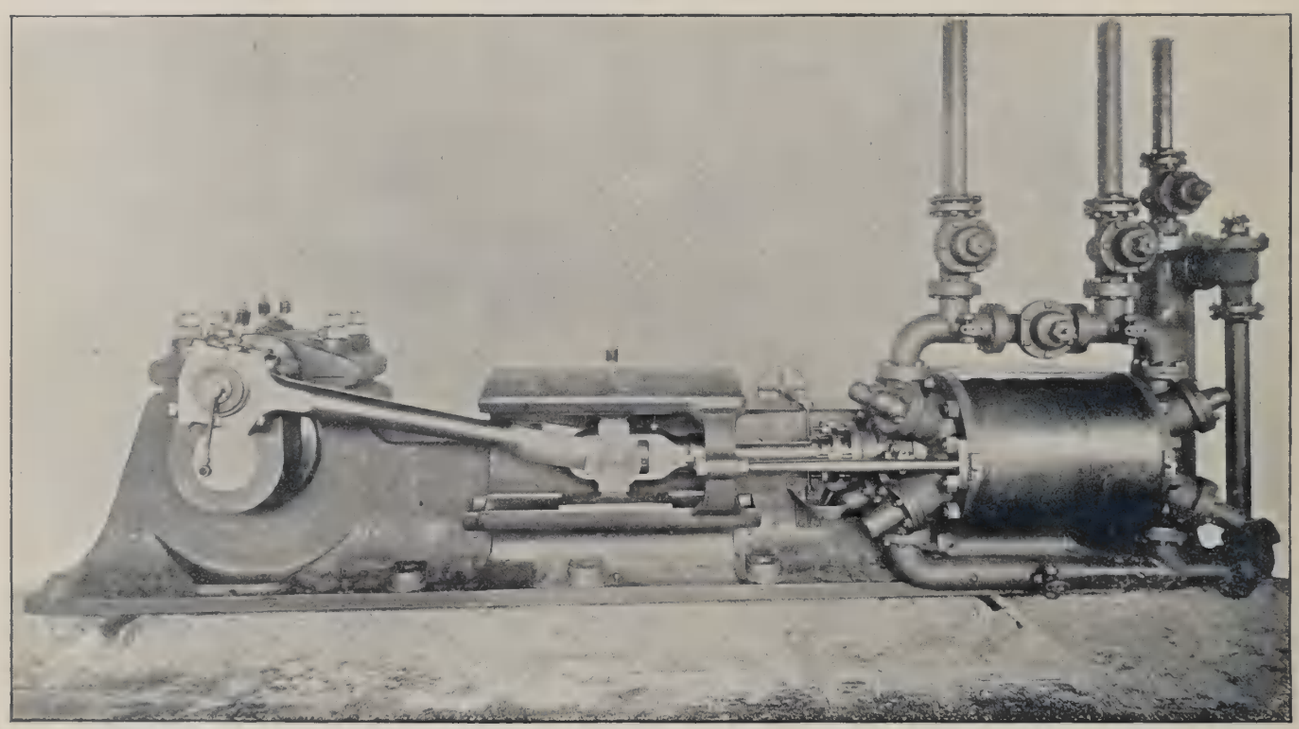
Liquid Anhydrous Ammonia

ABSOLUTELY DRY, PURE AND UNIFORM ALL THE YEAR ROUND . . . . .

26° Ammonia

SPECIALLY PURIFIED FOR ABSORPTION . MACHINES . . . .

All our Ammonia is made from Sulphate Ammonia only. Large capacity, best qualities and quick shipments.



No. 8 LINDE COMPRESSOR

100 TONS CAPACITY.

MANUFACTURED BY

THE FRED. W. WOLF CO.

560 North Halsted Street, CHICAGO, ILL., U. S. A.

FOR ICE FACTORIES, COLD STORAGE HOUSES, BREWERIES AND PACKING HOUSES . . . . .

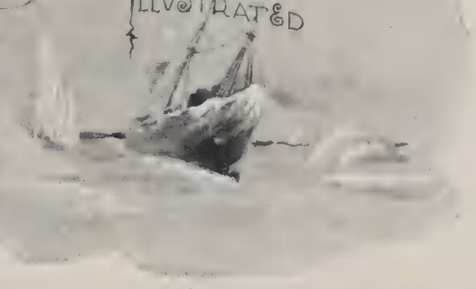
CORRESPONDENCE SOLICITED. . .

OVER 1300 MACHINES IN ACTUAL OPERATION.

ICE AND REFRIGERATION

ILLUSTRATED

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.



VOL. I. NO. 4. CHICAGO : NEW YORK : OCTOBER : 1891. $2.00 PER ANNUM.

[*Written for* ICE AND REFRIGERATION.]

ARTIFICIAL REFRIGERATION.

A CHRONOLOGICAL STUDY OF ITS DEVELOPMENT—ITS IMPORTANCE, ITS APPLICATIONS, ITS FUTURE.

BY AUGUSTE J. ROSSI, B. S., C. E.

[*Continued from September Issue, page 143.*]

The experiments of Faraday and Thilorier, by showing that certain gases could be liquefied under pressure, and that the liquids thus obtained could produce an intense cold by their spontaneous evaporation, were the pressures over them relieved, paved the way for the future discoveries. The manner in which this relieving of pressure could be realized was relatively of a secondary importance, as long as the fact itself had been ascertained. Absorption by suitable substances was the agent resorted to in the experiments of Faraday, and it led to a distinct system in the future, but the exhaust pump had been also used even as early as 1810, by Leslie, for the same purpose, as we have seen, and the rapid development of the mechanical arts under the impulsion given by the discovery of the steam engine, soon furnished the means of producing and reducing economically such pressures mechanically.

It was found, however, that a few gases, called for this reason "permanent," air, among others, could not be liquefied, at least, at the pressures, extreme as they were, that it was possible to attain then, and the consideration of another physical law relating to such gases—a law which experiment had already discovered—soon led to other conclusions of the highest importance.

If in a smooth cylinder of stout glass, closed at one end, and obturated at the other by a close-fitting piston, which can be moved in the cylinder by means of a proper rod extending outside, air is suddenly compressed by pushing the piston to the other end of its stroke, the air is heated to such an extent as to set fire to a piece of punk, left purposely at the further end of the glass cylinder in a cavity provided for it; this firing of the punk supposes a temperature of 450 deg. F. This experiment established the fact that the compression of a permanent gas, such as air, generated heat. Repeated with other gases, which could be liquefied, but without pushing the compression to the extent of bringing about the liquefaction of such gases, it was proved to be a common property of all gases, which explains the advisability of cooling a gas during compression when wishing to liquefy it, heat acting, as we have mentioned, as a retarding agent in such case by diminishing the cohesion in expanding the particles.

But it was also observed, that were this heated air under pressure and thus reduced to but a fraction of its original volume, allowed to resume its original bulk by pushing back the piston to its initial position, it would cool sensibly to the temperature it had before its compression. For instance, were the air, taken at a temperature of 90° F., compressed by the piston so as to raise its temperature to 190° F., by allowing this air at 190° F. to expand in pushing back the piston so as to resume its original bulk, its temperature would return from 190° F., the final temperature, to 90° F., the initial one, a fall of 100° F. Nothing is thus gained for purposes of refrigeration. But if this air at 190° F., and while under this compressed state, were to be cooled to say 100° F. by proper means, and then, only when so cooled, be allowed to resume its original volume under proper conditions, it would be expected that its temperature, now of 100° F., falling through a range of 100° F. as before, would reach 0° F., furnishing thereby the means of producing an intense cold. This was verified by actual experiment to be the case, within some limits, and if the range of lowering the temperature was not found to be equal to the range of increase in these conditions, this was due to reasons of a technical order, not within the scope of this present article; but, however, a very large portion of this fall of temperature was observed to take place, more than enough to open the way to an industrial application. On this simple experiment, easily repeated, and a curiosity of the lecture room toward the end of the last century, has been based the mechanical system of refrigeration, which, in our modern times, has been known under the appellation of "air machines."

The phenomena relating to the evaporation of liquids, spontaneously or otherwise, for the liquefaction in certain conditions of pressure and cooling of substances known to exist only in the gaseous state in ordinary circumstances—those bearing on the compressibility of gases not liquefiable (at this time, at least), like air, to their ultimate heating and cooling by compression and subsequent expansion—were well studied, scientifically discussed and thoroughly experimented upon from the beginning of this present century, and, from this date, artificial refrigeration made rapid progress. All over the world patents were secured realizing industrially the ap-

plication of one or the other of the physical principles involved: but, before proceeding any further in a very rapid and succinct examination of such developments, it may be advisable to retrace our steps and to resume all that has been said before, by classifying, so to speak, the different methods of producing cold examined according to the principles discovered or observations which, applied in early times, have furnished somewhat crude and imperfect solutions of the problem, or which, applied later on, have made of preceding researches the basis of the actual systems of industrial refrigeration.

The different methods of producing cold artificially can be summed up as follows:

First.—Methods based upon the spontaneous evaporation of the less volatile liquids, like water, promoted or not by any special devices.

Early applications—Cold water, alcarazas, limited production of ice in India and other countries.

Promoted by exposing the liquids on a large surface, artificially obtained, to the action of the air. Concentration of saline solution: cooling of syrups and warm liquids.

Second.—Methods based on the evaporation of liquids like water, but preferably, when possible, of liquids more volatile promoted by the passage of a current of air through and over the mass.

Early applications—For water, cooling of warm liquids, of water itself, promoted by the state of dryness or of non-saturation of the air in moisture. Later applications—Passing air through cheap liquids more volatile than water, small machines of modern times.

Third.—Methods based on the evaporation of a liquid, like water, the evaporation being promoted by relieving the pressure of the air and of the vapors given off, over the liquid, by means of a mechanical device such as an air-exhausting pump, the relieving of pressure being promoted, in special cases, by absorbing the vapors given off.

Early applications—Experiment of Leslie.

Later applications—Machines for the production of ice in important but limited quantities for family use (type F. Carré's machines), production of any amount of cold or ice for industrial purposes (type of Windhausen's machines).

Fourth.—Methods based on the properties possessed by certain substances, solid or liquid, to absorb the vapors of a very volatile liquid—so volatile, in fact, that it can only exist and is only known as gas at the ordinary temperature and pressure of the atmosphere—liquefied gas, ammonia, for instance; methods which consist in driving out by heat from the absorbent solid or liquid saturated with such gas and contained in a closed vessel, the said gas or vapor which, being confined and cooled, will by making pressure on its own particles return to the liquid state, the liquid thus obtained being subsequently allowed to evaporate spontaneously in proper vessels, thereby producing an intense cold, the evaporation being promoted by the removal of the vapors as fast as formed by their being reabsorbed by the original absorbent properly cooled.

Early applications—Faraday's experiment with ammonia gas absorbed by chloride of silver. Later applications—Small machines also using a solid absorbent; the chloride of calcium, and the gas ammonia as agent of production of cold, exactly as in the Faraday experiment.

Later applications—Small and industrial machines using ammonia also as cold producing agent and water as liquid absorbent of this gas. Type F. Carré's machines, and all the other absorption ammonia machines of our days producing cold or ice in any quantities.

Fifth.—Methods based on the use of frigorific mixture obtained by mixing pulverized ice or snow with certain substances, or by dissolving certain salts in water, the cold produced being utilized in any appropriate manner.

Early applications—Iced salt. The making of frozen blocks of creams and limited application to cooling experiments in laboratory whenever a low temperature was required. Later applications—Cooling of liquids or production of artificial cold by means of special dispositions in our days, with more or less success. Solution of certain salts in water: Early applications—Frigorific mixtures for laboratory experiments. In our day small machines of a limited production of ice per hour, and even attempted application on a large scale.

Sixth.—Methods based on the evaporation of very volatile liquids obtained from gases liquefied by pressure, which liquids, being confined in closed vessels, are then caused to evaporate, producing thereby an intense cold, by the continuous relieving of the pressure of the vapors on their surface by means of a mechanical contrivance, such as an exhausting and compressing pump, said vapors or gases being subsequently liquefied anew under the pressure produced by the action of the pump, aided by proper cooling, thus re-forming the original volatile liquid which is returned to the vessel from which it has first evaporated, as fast as the pump causes it to evaporate.

Early applications—The liquefaction in these conditions of most of the gases known by means of proper pumps, toward the first part of our present century.

Later applications—All the systems of refrigeration of our day known as systems by mechanical compression, and using divers volatile liquids and contrivances in order to realize the best conditions of success.

Seventh.—Methods based on the compression of non-liquefiable gases, such as air, by means of proper mechanical devices, cooling the gas while it is thus compressed, and allowing the said cooled compressed gas to expand in certain conditions, thus causing a considerable fall of temperature in the air—cold which can be utilized for any purposes of refrigeration.

Early applications—The well known experiment of laboratories to set fire to an inflammable substance by compression of air in a glass cylinder. Later applications—All the systems of refrigeration known under the generic term of "air machines."

(TO BE CONTINUED.)

NEW BOOKS.

"Thermodynamics, Heat Motors and Refrigerating Machines." By De Volson Wood. New York, 1891. John Wiley & Sons. 8vo, cloth, pp. 466. Price, $4.00.

This is the fourth revised and enlarged edition of this valuable work, which gives a comprehensive account of the theories of heat, gases and vapors, and their application in the construction and working of the various kinds of steam and gas engines and other prime motors, as well as of the different systems of refrigerating machinery. The book is gotten up in the elegant style characterizing the publications of this firm, and is profusely illustrated.



ICE HOUSE CONSTRUCTION.

SOME GENERAL PRINCIPLES APPLICABLE TO THE BUILDING OF HOUSES FOR ICE STORAGE—SUGGESTIONS IN INSULATION—THE PACKING OF ICE FOR STORAGE.

An ice factory in a northern state has propounded the following queries: "We are building an ice storehouse 140 feet long, by 28 feet wide, and 14 feet to eaves of the roof; we expect to divide this building into five apartments by partitions packed with sawdust, having a two-inch opening extending theentire length of each side and end for the admittance of cold air. Our intentions are to cover the building with shingles, and have a ventilator with slats extending the full length at the top for the foul air to escape. We will pack our ice in straw in this building during the winter. Is it necessary that the building should have a ceiling packed with sawdust? Is it necessary to have a ceiling at all?"

These gentlemen are in the same position in which many ice manufacturers find themselves. Their town does not nearly consume the product of their plant, and it becomes necessary to store ice for shipment, as well as to supply the demand in excess of daily production which occurs during three or four months only, out of the twelve months of the year. The question propounded, therefore—how to build a good ice storage house—is one of general interest. In this case, as in all others where a question of universal interest is proposed, ICE AND REFRIGERATION invites a discussion of the topic by its readers. In the meanwhile, however, some principles may be laid down of a general nature.

The essential features of all good houses for the storage of ice are: Heat non-conducting walls; exclusion of air from the sides and bottom; ventilation of the top of the ice; and good drainage.

The insulation of the ice room is one of the great problems of ice house and cold storage warehouse construction, but the system adopted will, of course, depend on the purpose to which the house is to be put. In general, for the simple storage of ice, frame buildings are the rule, and the rule has but few exceptions, on account of the cost involved in a better construction. This construction is cheap, and wood is itself a very good non-conductor. To render the walls non-conductive of both heat and air, it is usual to introduce an air space, or a space to be filled with sawdust, spent tan bark, ashes or some other non-conductor of heat (pulverized charcoal is excellent when obtainable at a reasonable cost). Layers of building paper may also be used to advantage. Probably a combination of all these methods would give the best results, provided the expense be not limited to a certain sum. If the air space is employed, ventilation must be provided to keep the air pure; and in the case of a space filled with sawdust, etc., care must be taken also to prevent moisture from reaching the filling material, since the moisture would not only damage the structure itself, but as well would destroy the value of the filling as a non-conductor. Ventilating holes under the eaves will afford opportunity for this moisture to evaporate. The double roof is very desirable, but in general what is deemed sufficient protection against heat is obtained by planking the roof rafters above and below, thus making an air space of the thickness of the rafters.

The drainage of the bed on which the ice rests must be done in such a way as to prevent the penetration of warm air from without, and also the escape of cold air from within, thus creating a current of air through the ice, a difficulty which can be met by having a water seal trap constructed in the drain pipe.

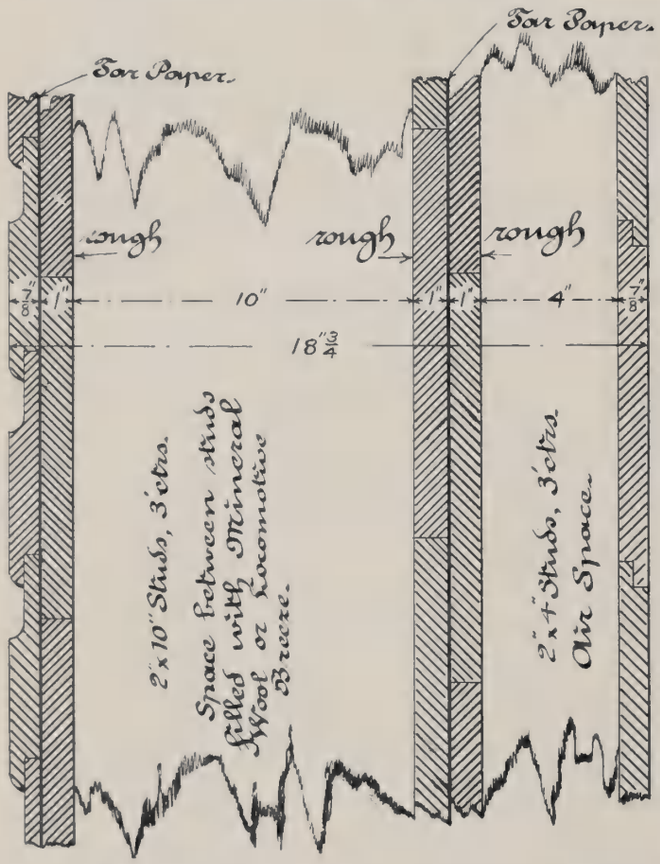
The floor should be laid higher than the ground, in order to keep the bed free from surface water, and away from the influence of the heat in the earth itself; and it is usual, unless the soil is porous, to construct a bed of ashes, coal screenings, clay or broken stone, whichever is the more convenient, dishing this bed from the sides to the center, both to facilitate drainage by turning the water quickly into the drain pipes, and also, in case of ice sliding, to throw the pressure of the ice to the center. An air space is made here also by laying a cheap floor of slabs or rough plank on mudsills or scantlings laid on top of the made bedding of ashes, etc.

Ventilation of the top of the ice is necessary to prevent "sweating"; but the ventilation should be such as will keep the air pure and dry, but without creating a current of air over the ice. Where houses are of a considerable height some builders introduce small board windows in the sides of the building so that when the level of the ice is below the windows, they may be opened to purify the air in cold weather or on cool nights.

The walls will absorb less heat if the exterior be painted white or whitewashed, and, whenever practicable, doors and ventilator openings should be on the north side of the building to avoid the entrance of the sun's rays direct when the house is opened. In packing away ice, the top layer is protected from contact with

the air by a cover of sawdust, salt hay, etc., which also should be used on the sides to prevent contact of the ice with the walls.

This is the commonly approved system of constructing ice houses, but as one authority, Mr. Berg, of the Lehigh Valley railroad engineering department, suggests, "it can be said in a general way that the air spaces or width of openings in the walls to be filled with some insulating material are too small to give the best results, and that, further, the insulation of the roof is usually imperfect." It is a practical economy as a rule to put a little more expense than is commonly done in perfecting the insulation of ice house walls; and the following figure represents a section of an ice house wall recommended by Mr. Geo. F. Knox, of the construction department of the Hercules Iron Works, Chicago.



Mr. Knox adds: "We do not recommend sawdust for filling, as it gets wet in time, and is a detriment, in place of a benefit. Your idea for a slot for cold air is all right. The ventilator on top of the building to allow foul air to escape is absolutely necessary. We recommend a ceiling well packed with insulating material to protect the top of the ice from the rays of the sun, and make the roof extend well over the walls of the building. Chopped straw is good for packing ice."

In the matter of packing ice from the machine for storage, the Pure Ice and Cold Storage Co., of Springfield, Ill., say that they packed ice in planing mill shavings during the past season, and in August took out ice that they put up in February last, that was packed when the weather was warm and most of the time above freezing. They set the blocks on end (they are 14×14×32 inches) as close together as they could, and put about eight inches of shavings around the outside; laying one tier on the flat side at the bottom and one at the top. The top tier was all melted, and about one-half of the bottom, while the blocks on end did not lose more than about five pounds each. Theirs was a very poor house, all open on top for twenty feet to the roof, and had but ten inches of pine shavings over it. The year before they packed some ice with the same kind of material, and mixed some fourteen-inch ice from Madison, Wis., in the same house, and the machine ice came out fully as good as the other. They also have rooms, cooled by brine, in which they keep from ten to twenty tons; also rooms in which they have packed seventy tons on 1×4-in. strips, and kept the temperature down to freezing and below, and the ice would do very well for a while, but would lose in weight and appearance when exposed to the air, even though it were cool air. There was nothing different about the construction of the houses they used from the old-fashioned ice house, only they were too small to be economical, holding only about 150 tons each.

While on this topic we might add that we have received a letter from California, in which the writer says:

"We are discussing the matter of building an ice storage house, and would be pleased to hear of the experience of ice manufacturers as to the best methods of storing ice made by the absorption process.

"We built two bins, 7×7×7½ feet, in our ice room, that is refrigerated with brine pipes. In one we put sawdust between the cakes, and covered tightly with boards and sawdust. In the other we put sawdust around the edges, or outside border, and covered with boards, and then with sawdust. Both bins were nearly air proof, and had concrete bottoms with boards imbedded in the concrete. The concrete also had grooves in it to carry off the water. Both bins were so inclosed for five months, and both opened up well, and gave us merchantable ice of about equal value."

The Carthage Ice and Cold Storage Co., of Carthage, Mo., use for ice storage rooms which are built with a view to utilizing them for a portion of the year as cold storage for perishable merchandise, fruits, etc., and they simply employ them for ice storage as relay or supply rooms during the ice season proper. "The piping is placed on the side walls," says Mr. C. M. Gay, manager, "using one-inch pipe, six-inch centers; and in wide rooms with box coil through center of room, all arranged for short circuit brine circulation, and with one lineal foot of inch pipe per eight cubic feet of room space. All the pipe work is provided with galvanized iron drip troughs, and connected with sewer drainage. Wall pipe is placed five and one-half inches clear of walls. By circulating 16° to 18° brine, a constant temperature of 30° to 31° F. is maintained, and the shrinkage is very slight. The floors are double and water tight, having double course of paper and pitch between them, and with a drainage pitch of one-eighth inch to the foot to a side gutter. The insulation consists of six inches of cinders between plain boxing or sheathing; then a six-inch dead air space, finished inside with two layers of paper between courses."

Mr. Gay says: "We find the first story of our storage house of great convenience for preserving, practically without waste, whatever surplus ice we have on hand, to the extent of 200 to 300 tons at times; but as it requires on an average an expenditure of at least one ton of refrigerating duty per twenty-four hours for each 100 tons of ice so preserved, one can readily see that there is a limit to the practical value and utility of refrigerated storage for ice."

ATMOSPHERIC CONDITIONS AND BACTERIOLOGICAL INFECTION.

BY J. E. SIEBEL, DIRECTOR OF THE ZYMOTECHNIC INSTITUTE, CHICAGO.



ALTHOUGH we know that the presence of bacterial germs in the atmosphere is by no means so overwhelmingly great as was formerly supposed, nevertheless their influence cannot be ignored in dealing with the problems of hygiene, as well as with those connected with various industrial pursuits and with the economies of daily life, and facts bearing on the general behavior of these little and, for us, still invisible beings are especially serviceable in the consideration of these problems.

The experiments related in the following were made with the object to show the proclivities of atmospheric germs under certain conditions—notably their behavior at different temperatures and under different conditions of moisture. For this purpose a number of dishes containing food solutions (neutralized and well sterilized beef broth, urine, vegetable decoctions), were placed, some of them in ice water, others in baths of elevated temperatures not exceeding 115°, others in rooms saturated with moisture. Some of them were covered with hoods, or roofs, leaving spaces for the circulation of air, but preventing the falling in of atmospherical dust. It turned out that the liquids not exposed to a high temperature, especially those exposed to an atmosphere almost saturated with moisture, gave unmistakable signs of decomposition after a space of thirty-six hours; while the others remained clear for a much longer period. Those dishes exposed in ice water for six hours and afterward exposed at a higher temperature turned also cloudy and putrid in a short time.

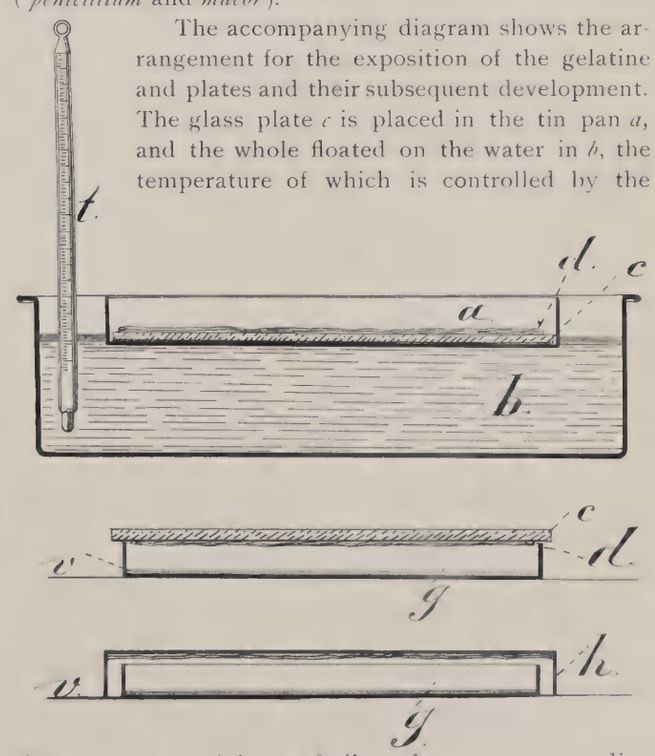
These and similar results, while indicating in a general way the tendency of bacterial germs to alight on cold surfaces, to avoid hot surfaces or at least such exhaling moisture, were nevertheless not calculated to give exact or numerical results. To obtain these, I resorted to gelatine cultures, and eventually to a modification of the so-called plate cultures, as giving the most satisfactory, that is, the most positive results.

The contrivances finally arrived at were adaptations of Koch's gelatine plates. The food gelatine was either spread on glass plates or on the bottoms of shallow tin dishes, which were made to float on water kept at the desired temperature. The glass plates were kept at a certain temperature in a similar way by being placed in shallow tin dishes floating on a water bath. The food gelatine subjected to evaporation was diluted correspondingly. As a matter of course all the dishes, plates, gelatine, etc., were thoroughly sterilized.

In one set of experiments two shallow dishes, the bottom of which was covered with diluted beef gelatine, were exposed in a water bath to a constant temperature not exceeding 115° for six hours. After this time the dishes or pans were withdrawn, the gelatine allowed to set, and then the dishes were inverted over smaller tin pans, the bottom of which was covered with several layers of moist filtering paper. After having been left in this condition for forty-eight hours, the plates were examined, but no specks of bacterial or fungoid growth could be detected on either of them. Side by side with the above, two similarly prepared dishes were exposed on a mixture of ice, salt and water, for the same length of time (six hours), after which they were inverted over dishes with moistened bottoms as before. After forty-eight hours both plates showed from 200 to 250 specks of growth each, most of them bacterial colonies of the gelatine liquefying kind, and a few mold specks. Simultaneously with the above, two other dishes, similarly prepared, were exposed at the temperature of the room, which at the time was 73°, the bulb of the wet thermometer showing 68°. These, on being treated in the same manner, after forty-eight hours showed twenty-six and the other thirty-four specks, of growth, many of which were of the fungoid character.

Similar results were obtained at other times, and while the number of bacterial specks on the infected plates varied, the gelatine which was subjected to high temperature always remained intact.

Another series of tests was made, the gelatine being replaced by glass plates moistened with glycerine. After exposure under different conditions as above for six hours, gelatine was carefully spread on each, and the plates inverted over small tin pans containing layers of moist filtering at the bottom. After forty-eight hours the plates were examined for growth specks. Those which had been exposed on ice showed about sixty and ninety specks, chiefly bacterial, respectively; of those which were exposed at a temperature of 115° one showed no specks at all, and the other two mold specks (*penicillium*); of the glass plates exposed at the temperature of the room, one showed eight and the other six specks, of which five respectively four were of a fungoid character (*penicillium* and *mucor*).



The accompanying diagram shows the arrangement for the exposition of the gelatine and plates and their subsequent development. The glass plate *c* is placed in the tin pan *a*, and the whole floated on the water in *b*, the temperature of which is controlled by the thermometer *t*. A layer of oil on the water surrounding the tin pan *a* prevents the influence of evaporation of the surrounding water. For other experiments the vessel *b* is filled with ice and brine. After exposition the

germs on the gelatine *d* on the plates or in the bottom of the tin pans are developed by placing the plates or pans inverted over smaller and lower pans *g*, containing water or moist filtering paper *r* at the bottom, as shown in the lower two cuts. The results obtained as stated above, which I might reinforce by others, though less concise ones, obtained in other ways, justify the following conclusions:

1. Surfaces exhaling moisture, or to a certain extent surfaces exhaling heat, are protected against bacterial infection.

2. Surfaces colder than the surrounding atmosphere, especially if their temperature is below the dew point, are readily infested by bacteria.

From this it follows that bacterial infection is most active in an atmosphere charged with moisture, especially when the moisture reaches the point of saturation, that is, when mist and fog are being formed. Such conditions are brought about by air currents of different temperature mixing with each other, by changes in temperature and pressure of atmosphere, thus, perhaps, in some manner accounting for the increase of many ailments during changeable weather, while continuous cold and dry weather, as well as steady hot and dry weather, is characterized by the comparative absence of infectious conditions. The specific infectious character of many localities may in some manner be accounted for by the conditions mentioned, notwithstanding the direct effects which those conditions have physically, outside of bacteriological infection.

The facts mentioned find also numerous confirmations and applications in the economy of daily life. Many perishable articles kept in well ventilated rooms, subjected to a slight evaporation, are kept from spoiling. On the other hand, very cold eatables, frozen meat, etc., do decompose very readily after being exposed to a higher temperature. The danger of eating or drinking very cold dishes would seem to be increased by their exposure to the atmosphere, etc.

In the industries connected with the manufacture of articles of food and drink, these principles also find numerous application. The infection of beer worts in breweries when exposed at too low a temperature on the cooling vats is a case in point, and one which caused considerable trouble in ante-artificial-refrigeration times. The reported infection of some kinds of natural ice with bacterial germs is probably to be explained by its having been exposed to a moist atmosphere instead of a clear one, at certain times during its formation.

ICE MACHINES AT ARMY POSTS.

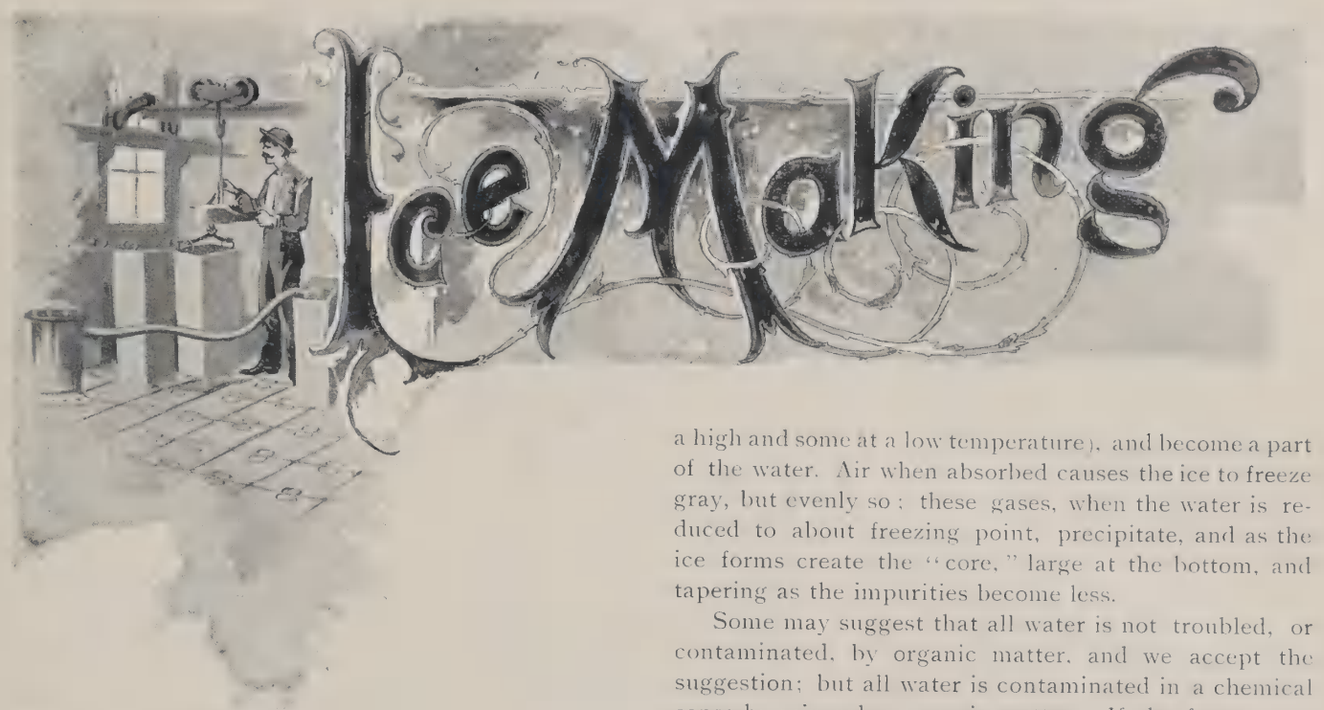
Notwithstanding the complaint which came to ICE AND REFRIGERATION from Brownsville, Tex., in August last, that the army post ice machines had entered into competition at that point with the local ice factories, with disastrous results to the latter—a species of manufacturing which is needlessly unfair—the introduction of ice machines at army posts, particularly those situated in the far South and Southwest and the southwestern territories, where the heat is severe and long continued, is to be commended and encouraged from a humane point of view. While, happily, our country does not require a large standing army, it does require a small army; and it has been found by experience that it is exceedingly difficult to keep even the small army we have, of 25,000 men, up to its full enrollment. Army life in times of peace offers few attractions to either officers or men—to the latter fewer than to the officers, and desertions are as numerous as the enlistments, which, of course, are strictly voluntary. Anything, therefore, which adds to the comfort of the men will have its effect in inducing contentment, and thus add to the efficiency of the service.

It will hardly be questioned that the ice machine does add to the comfort of the men. Not only does it make it possible for the mess to serve fresh meat that is wholesome (for all meat should be thoroughly chilled before it is cut for the broiler or roasting oven), but it also facilitates the storing of vegetables, makes palatable drinking water easily possible, and, above all, it is a valuable, if not indispensable, adjunct to the hospital, the surgeon in charge of which is usually in charge of the ice machine also. In this latter capacity the ice machine has a mission which nothing else can fill.

A notable example of consideration of this kind for soldiers occurred during the last campaign of the English in Egypt, when the British government fitted out four steamships with refrigerating apparatus and cooling rooms to supply ice to the troops in Egypt. The vessels were not fitted to carry ice, but distilled sea water and then froze it in sufficient quantity to keep not only the hospitals but also the barracks well supplied with ice. It was then found that ice delivered from the cold chamber of the ship was much superior to that frozen on shore, since storage in the cold chamber, in an atmosphere at 0 to 15° F., improved the solidity of the ice, and consequently lasted longer than the ice made on shore. It was also found that ice could be carried from Norway to Egypt at about the cost of making it in Egypt by machine; but after its arrival there it could be kept frozen only by storing it in receptacles cooled artificially—which might suggest the possibility of maintaining commercially the old ice trade of the North with the tropics, the consignee in the tropics having a refrigerating machine on shore to keep the ice frozen after its delivery. The English example was afterward followed by the Italian government, which carried ice to the troops at Massowah (Abyssinia), which, with the assistance of the ship's refrigerating machine, was delivered almost under the equator in fine condition, and did much to lessen the hardships of the troops stationed there, as it had previously of the English in Egypt.

In addition to preserving food and furnishing ice for the hospital and the men in quarters, the refrigerating machine has been recommended to European army transportation departments for use on board troop ships carrying men through the tropics. By its use a constant supply of fresh meat can be issued to both troops and seamen during the voyage, with excellent effect from a sanitary point of view; and at permanent garrisons the condition of the men is greatly improved by its use for cooling hospital wards, the barracks, and the office buildings in tropical countries.

BY MEANS of cold storage the Edgerton, Wis., creamery company realized an advance of two cents a pound on twelve tons of butter recently forwarded to Boston. The company, August 27, had over 100,000 dozen of eggs in store.



[*Written for* ICE AND REFRIGERATION.]

THAT WHITE CONE IN ICE.

FURTHER VIEWS ON A TOPIC INTERESTING TO ICE MANUFACTURERS—WHAT CAUSES THE CONE IN ICE—THE REMEDY AND THE REASON.

BY STUART ST. CLAIR, "FRIGIDITY" AND OTHERS.

The writer, who has had a practical experience of twelve years in artificial refrigeration, six of which were in the commercial production of ice, wishes to accept the invitation extended to furnish his mite on the subject of "White Cone in Ice" treated upon in your last issue.

J. R. W., of Alabama, has given this subject careful thought, and has in a measure explained the cause and nearly supplied the remedy. The writer has worked on this problem for years, and, as a proof of his success in the matter, has to-day many plants in operation that are producing perfect ice, regardless of quality of water. But as the water after purification is remarkably sensitive to pollution, careless manipulation on the part of the operator will at times produce temporary bad results.

"What is the cone?"

To intelligently answer that query, we must know exactly the nature of the water, but a cone will exist in a greater or less degree from nearly all waters. The common theory that distillation purifies water, should be amended by using the adjective "proper." The *proper* distillation of water will produce an absolutely pure result.

A chemist who wishes to distill water, where absolute purity is requisite, usually first uses a coagulate, or precipitate, and disposes of the organic matter in this manner, and then, by the use of gentle heat, never as high as 212° F., obtains a perfect distillate. Now, commercially, we use steam of high tension for motive power, and as a consequence all organic matter is decomposed, thus producing gases intermingled with the steam that are *incondensible*, but unfortunately not *unabsorbable*. The consequence is that when the water of distillation is cooled, these gases are absorbed (some at a high and some at a low temperature), and become a part of the water. Air when absorbed causes the ice to freeze gray, but evenly so; these gases, when the water is reduced to about freezing point, precipitate, and as the ice forms create the "core," large at the bottom, and tapering as the impurities become less.

Some may suggest that all water is not troubled, or contaminated, by organic matter, and we accept the suggestion; but all water is contaminated in a chemical sense by mineral or organic matter. If the former, say lime or magnesia, you will readily produce carbonic acid gas, both free and combined, and produce the cone. But in all cases when mineral water is used, you always see a better quality of ice, all else being equal. But the writer claims that any water, even sewage, can be used with perfect safety and perfect results.

The Remedy.—"J. R. W." hits the nail fully on the head in one sentence: "A very free flow of steam from the exhaust of the steam condenser"; and a high temperature.

The Reason.—A free escape of the gases before the temperature of distilled water reaches a temperature sufficiently low to absorb them.

What is that temperature at which they will absorb? is often asked. We don't know, simply because there are many different gases thus generated, and among them some that will absorb at very high temperatures. Consequently a free and continuous flow is necessary to eliminate the same. A high temperature and free exit for all gases will cure this evil. The writer has never found it necessary to use any filters or deodorizers, producing the result with a simple apparatus, dependent entirely upon heat. The discolorations are produced by the presence of free oxygen in the distilled water, liberated by the decomposition of organic matter described, and hence an oxide of iron from contact with pipes and vessels is the result.

ANOTHER THEORY.

I have read with much interest the replies to the question propounded by L. E. B. in No. 3, of ICE AND REFRIGERATION, and as others are invited to join the discussion, I will endeavor to explain my views in regard to the subject.

I do not think that the cone (and core) is entirely due to the presence of air, but is composed of air and impurities—both or either.

I made a few experiments when I started in the ice business to locate the cause. First, I stopped reboiling the water, which had the effect of increasing both core and cone. I then (after starting the reboiler) shut off the coke filters, which the distilled water passed through

after leaving the cooling coils. This had the same effect. I found that unless the water is de-aerated by reboiling, although a good system of filters is used, we would have the white cone. This shows that the presence of air causes trouble to some extent. I also found that there was something besides air, for unless we subjected the water to a proper course of filtering, although it was first de-aerated, we would still have the trouble. As I am not a chemist, I will not attempt to tell what constitutes these impurities, but will endeavor to explain how they may be avoided to a great extent.

We will suppose that the water is properly de-aerated at the reboiler. We should then be careful that there are no air leaks in the pipes, by which air may be drawn in as the water passes down to the distilled water tank. We should also see that the water does not stand exposed, as it may absorb air. We must have a suitable check or foot valve on the bottom end of the filling pipe to prevent air getting into the filling hose. There are patented fillers advertised in the columns of ICE AND REFRIGERATION which "fill the bill" nicely, and the can, too.

I found that it is very difficult to make clear ice where the boilers are overtaxed, as the current of steam carries with it a greater amount of impurities which cannot be eliminated even by the most approved methods. I have also found that if the boiler is not kept clean we will have trouble. Again, if the safety valve is allowed to blow much it will have the same effect. By clean boilers I do not mean that they must be free from scale or sediment, but they must be opened and the water changed entirely and thoroughly washed out. Last season I had charge of an ice factory where the water was simply perfect for all ordinary steam purposes. It did not form a particle of scale or sediment, and other boilers using the same water were run as long as a year without washing out, with no bad results; yet I was compelled to wash out my boilers at least every two weeks in order to make a good quality of ice. Therefore, in order to make good ice you will have to have boilers large enough to do the required duty without crowding. You will need a fireman that will attend strictly to business and not allow the safety valve to blow, and to carry water right and not "three rings up the smoke stack," and give you saturated instead of dry steam. Even with all of these precautions with the boilers, we shall have to keep a strict watch over the filters and see that they do not become foul.

It is a good plan to have the ice pulled at regular intervals, and allow the reboilers to overflow a little between each and every can filled. This can be done by having a float and valve in the distilled water tank, the float to be so arranged as to open the valve when one can-full is drawn from the tank, and close as soon as that amount of water runs in. When it closes it allows the reboiler to fill and overflow, the overflow carrying off many impurities which will rise to the top of the water when it is boiling.

I have never had any difficulty doing away with the discoloring sometimes found in ice by means of a sponge filter placed so that the water will pass through it after leaving the cooling jacket. This will also materially reduce the white cone, as the impurities, becoming coagulated by cooling, are more readily taken up by the sponges.

I believe that the cone (not core) can be reduced by proper proportions of cans. It is well known that the process of freezing forces out the most of impurities. This is demonstrated by the plate system, where clear, beautiful ice is made from comparatively muddy water, the mud being forced out of the ice as it freezes.

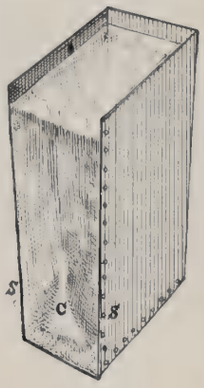


FIG. 1.

Fig. 1 represents a mold that is very generally used: one that will have some cone in spite of all precautions. This I think is caused by the ice forming on the side of molds at *s s*, closing at the center *c*, thereby preventing the impurities being forced up from the bottom. A mold made like Fig. 2 would allow the freezing from the bottom to force all impurities out on top; but this shape of mold would not be practicable on account of the large space required for the tank. I have seen molds twelve inches wide and fourteen inches square, which made no cone at all, but there would be a large, round core.


FIG. 2.

FRIGIDITY.

A SIMPLE REMEDY.

Another reader, W. F. O. S., says: "If L. E. B. will introduce the ammonia in the top of the expansion coils of the brine tank first, he will find it will improve the appearance of the white cone in his ice. The bottom of his brine is colder than the top, and the bottom freezes too fast. My ice is as clear at the bottom as it is at the top.



The volume of business in ice at New Orleans, says the *Item*, September 1, has been equal to that of the previous year. Two companies which were in the business last year were not in it this year, one, the Louisiana, not having operated at all, and another, the People's, having failed shortly after the beginning of the season. This, of course, threw an extra amount of trade in the way of the remaining companies, which have on this account been able to work to full capacity, and make the season a profitable one.

At Mobile, says the *Register*, a good local trade was transacted the past year, and the shipments to the interior were fair and about the same as last year, while competition caused prices to rule fair during the summer months. The plant of the Mobile Ice Co. has been entirely rebuilt, and new machinery added, giving it a capacity of fifty tons of ice per day. The Consumers Ice Co. was formed this year, and commenced to manufacture pure crystal ice in June. The plant is of the latest improved machinery, and has a capacity of twenty tons per day.

Generally speaking, inquiry for machines continues active for this season of the year, and while throughout the South building may not be as active, in proportion as in past seasons, the business being somewhat overdone, the additional building in the North will fully make up for any loss that may appear in the South.

ALABAMA.

Birmingham—The Artesian Ice, Storage and Fuel Co. has filed articles of incorporation; capital $40,000; incorporators, Wm. Hood, L. A. May, E. F. Enslen, R. N. Rhodes, J. W. Johnson; object, to make ice, provide cold storage, and handle fuel.

Bridgeport—The Electric and Ice Co.'s plant has been started up. Geo. A. Bebee has the work in charge.

Oxford—New Orleans parties are willing to supply Oxford with electric and ice plants if her citizens will give them $10,600. Why don't the Oxonians supply themselves and keep their $10,000?

CALIFORNIA.

Los Angeles—Los Angeles capitalists have begun the erection at Riverside of a $60,000 ice plant. They have leased the water power from the Riverside Water Co.

CONNECTICUT.

Norwich—Jonathan Trumbull will erect an ice factory. He has not purchased a machine.

FLORIDA.

Ocala—Mr. S. Benjamin has just set up a new boiler of larger capacity, and during the winter will replace his ice machine with a larger one.

Pensacola—Work has begun on the enlargement of the Stratton Ice Works, to include a new 25-ton Stratton machine, making a capacity of sixty-five tons—the largest in Florida. Underneath the addition will be several storage vaults with a capacity for storing 1,200 tons of ice. The work will be completed in about three months.

St. Petersburg—The new ice factory is nearly ready to begin operations. Water will be obtained from the lake.

Titusville—The Atlantic Coast Ice, Fish and Canning Co. will put in a 25-ton machine now building by the York Manufacturing Co.

GEORGIA.

Athens—C. J. Shelverton has organized a stock company to manufacture ice.

Dublin—An ice factory will probably be erected.

Rome—John C. Printup is at the head of a new company called the Rome Ice and Cold Storage Co., which has applied for a charter to organize to build a cold storage house and ice factory, with capital of $30,000.

Savannah—The De La Vergne Co. are erecting a 60-ton plant at the corner of Indian and Water streets, to be in operation by Christmas.

Madison—A gentleman from Birmingham will erect an ice factory.

Thomasville—Mr. W. T. Keefe, formerly manager of the Lithonia Ice Co., will build a 10-ton plant. He is now looking for a site.

ILLINOIS.

Centralia—The ice factory and cold storage scheme is again being agitated, and a capitalist from outside the city has agreed to subscribe liberally to a $50,000 stock company.

Chicago—The Midland Artificial Ice Co., Chicago, has been licensed to incorporate; capital stock, $10,000; incorporators, Abram M. Pence, Abraham Knickerbocker and George Albert Carpenter.

KENTUCKY.

Mt. Sterling—The Martin planing mill property will be remodeled for an ice factory and cold storage plant by A. J. and J. P. Cassiday.

LOUISIANA.

Algiers—William Wenzel, Gustav Maass, J. W. Webert and others have incorporated the Algiers Ice Manufacturing Co. to erect an ice factory, electric light plant, construct water works, etc. The capital stock is $50,000; office, New Orleans.

Donaldsonville—An effort is being made to organize a company with $30,000 capital to build a second ice factory, of which amount $18,000 was subscribed September 5. If the company is organized they will put in a 15-ton plant.

New Orleans—The Municipal Ice Co., organized in March last, began making ice September 1. The plant is a 50-ton Blymyer machine, with buildings designed for an ultimate capacity of 200 tons. The cost complete will be $250,000. The officers of the company are John Fitzpatrick, president; Samuel J. Hart, secretary.

MISSISSIPPI.

Yazoo City—A stock company will erect an ice factory.

MISSOURI.

Rich Hill—The Rich Hill Beer and Ice Co., has been incorporated, with a capital stock of $10,000.

St. Louis—F. Heguembourg is in the market for a five or six-ton ice machine.

NEW JERSEY.

Asbury Park—The Seaside Ice and Coal Co. has been incorporated by Monroe Hall and Benj. F. Powell, Jr., of Boonton, and Aaron D. Thompson, of Plainfield.

Bridgeton—Brickle Bros., known as the Cumberland Ice Manufacturing Co., will erect a 25-ton ice plant.

NORTH CAROLINA.

New Berne—The New Berne Ice Co will put in new machinery to increase the daily capacity of its ice factory from eight to sixteen tons.

Washington—C. H. Sterling will put in an 8-ton machine now being built for him by the York Manufacturing Co.

OHIO.

Cleveland—The Forest City Ice Co. is said to be in the market for an ice plant.

Cleveland—A company is being formed here to establish a new ice plant. The capital stock is to be $30,000, of which $15,000 has been subscribed. The estimated output is thirty tons per day.

Youngstown—A movement is on foot to start an artificial ice plant with a capital stock of $30,000. Something over $15,000 has already been subscribed toward the project.

OKLAHOMA.

Guthrie—The ice factory will double its capacity this fall.

PENNSYLVANIA.

Chester—The Consumers' Ice Co. are sinking an artesian well.

Collegeville—The stockholders of the Collegeville Ice Co. will rebuild the factory recently burned, and push the work as rapidly as possible.

Manayunk—A company has been formed to erect an ice factory.

McKeesport—During the winter new machinery and new boilers will be added to the ice works, increasing the daily capacity to fifty tons.

TEXAS.

Brenham—The Brenham Compress, Oil and Manufacturing Co., lately reported as incorporated, will start an ice factory.

Longview—Work rebuilding the ice factory is progressing rapidly.

Myrtle Springs—An ice factory and other industries will be erected here by the Texas Land and Industrial Co.

Palestine—A stock company has been organized to erect an ice factory. The mayor can give particulars.

Pittsburg—Wants an ice factory.

Velasco—Wants an ice factory.

Victoria—The Victoria ice factory is to be equipped with an entire outfit of new machinery.

VIRGINIA.

Harrisonburg—The Ice Manufacturing Co. will enlarge its ice plant.

Norfolk—The Hygeia Ice Co. has just set up their second 30-ton machine from the Columbus Iron Works Co., and will put in still a third as soon as it can be made for them.

WASHINGTON.

Aberdeen—A company has been organized with capital of $20,000 to build an ice factory and cold storage warehouse. Fred. L. Wagar can give information.

TRADE CORRESPONDENCE.

OFFICE OF J. KOENIGSBERG,
213 East Fifty-fourth Street,
NEW YORK, September 16, 1891.

To the Editor: I take pleasure in announcing to the public, and particularly to my patrons who were customers of the Consolidated Ice Machine Co., during the long period of my connection with that company, that I have recently made arrangements to serve them in the future. The De La Vergne Refrigerating Machine Co. has for some time past been the owner of letters patent No. 175,020, which were granted to James Boyle, March 21, 1876, for gas compressors. This patent covers the style of compressor used on the machine which I have heretofore been engaged in selling. Having severed my connections with the Consolidated Ice Machine Co., which made an assignment, October 14, 1890, I have now arranged with the De La Vergne Refrigerating Machine Co. to build refrigerating and ice making machines, under the letters patent referred to, and to furnish the same to such of my old patrons, and to new customers, as may desire to purchase them.

Your obedient servant,

JOS. KOENIGSBERG.

LEGAL DECISIONS.

INEXPERIENCED EMPLOYES—ACCEPTANCE OF DRAFT FOR CONSIGNMENT—TITLES TO BEDS OF INLAND LAKES—IMPORTANT COLD STORAGE DECISION.

Inexperienced Employes.

A seventeen-year-old boy working in a machine shop was ordered to stop the engine, and in obeying the order his clothing was caught by a set-screw in a rapidly revolving shaft, over which he attempted to step in going to the engine. *Held*, If, without any negligence on his part, and by reason of his youth and inexperience on the directions given him, he failed to appreciate the danger in passing over or by the shaft, in consequence of which he was injured, the employer will be held responsible for not properly guarding the shaft.—*Dowling* v. *Allen*, Supreme Court of Missouri.

* * *

Acceptance of Draft for Consignment.

Where a consignee of goods knows that the consignor has drawn upon him for the price of the goods his receipt of them amounts to an implied acceptance of the draft as well. A bona fide creditor of a consignor who holds the latter's draft for value, to which bills of lading transferred in blank are attached to secure its payment, is to be deemed the owner of the goods so far as to give validity to the pledge created by the forwarder, and on presentation of the draft with the annexed bills to the consignee before he has accepted the consignment is unquestionably entitled to the payment of his draft by the consignee.—*First National Bank of Starksville* v. *Meyer*, Supreme Court of Louisiana, 8 South. Rep. (433) 132.

* * *

Ownership of Beds of Inland Lakes.

The supreme court of the United States recently rendered an important decision which settles for all time the question of the ownership of the beds of inland lakes. The case decided is that of *Mitchell* v. *Swale* and *Hardin* v. *Jordan*. Conrad N. Jordan is the ex-treasurer of the United States, and he claimed title to the bed of Wolf lake, in the southern extremity of Chicago, an exceedingly valuable sheet of water used for ice-cutting purposes. Ejectment suits were brought against Jordan and others. Judge Gresham held Jordan's title to be good, and the case went to the Supreme Court, which reverses the ruling and declares that the land patents were given originally to the plaintiffs and that titles to the beds of inland lakes go to adjacent owners. A mandate in conformity with the opinion was issued by the Supreme Court, but the defendants are arguing a motion for a rehearing, as allowed by law in ejectment cases. The property in controversy is valued at several thousand dollars.

* * *

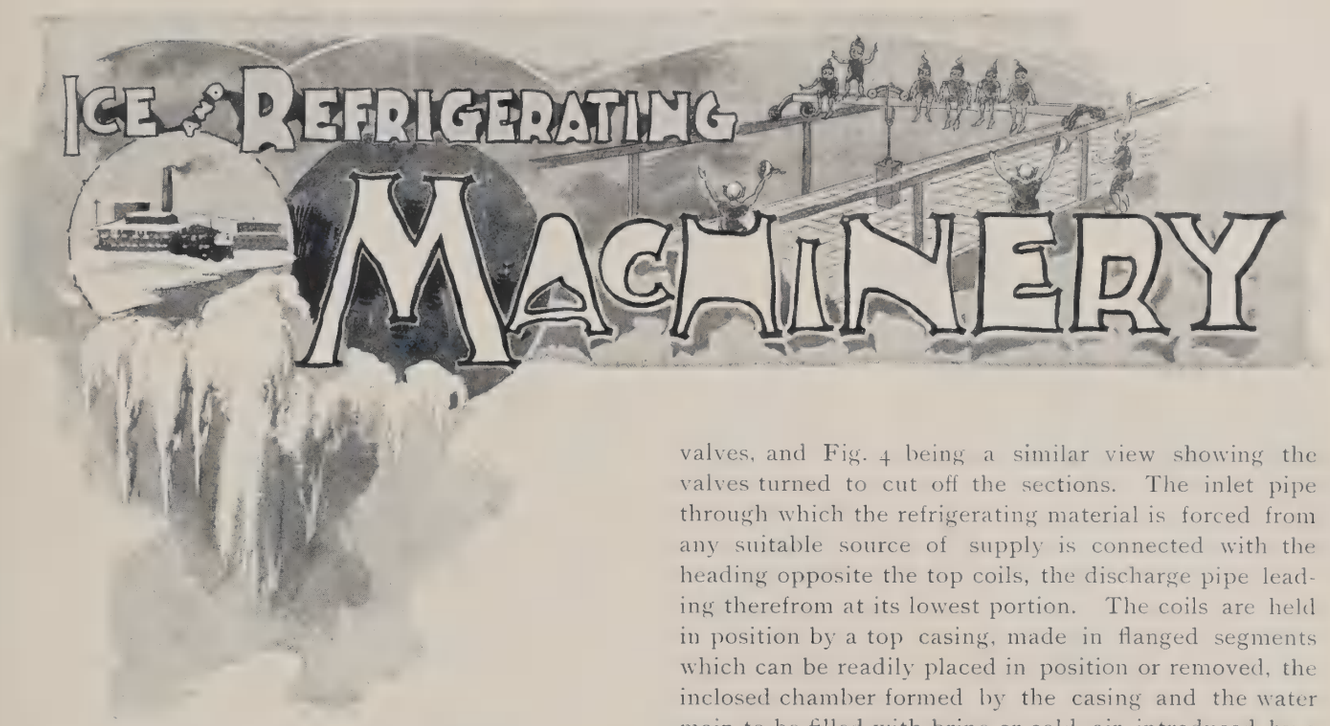
Cold Storage Decision.

The New York Court of Appeals recently handed down a decision of capital importance to managers of cold storage warehouses. The action inducing the decision was that brought by Stege & Behrman, poultry dealers, of New York city, against Linde & Co., for loss on dressed poultry, which spoiled while stored in the latter's cold storage warehouse. The history of the case, with the evidence adduced on the trial of the case in the lower courts, is substantially as follows:

On the 17th of August, 1885, Stege & Behrman received 242 barrels of poultry from John E. Sullivan, of Indianapolis. When the poultry arrived in New York it was examined and found to be in sound condition, and well iced. The market value of the poultry at the time of its receipt being less than the price paid for it, the plaintiffs, Stege & Behrman, entered into an agreement with the refrigerating firm of Linde & Co. to store it. The contract, a verbal one, was made on behalf of Linde & Co. by William H. Spencer, their manager. Mr. Spencer, among other things, said that they would "freeze the poultry as hard as a rock at half a cent a pound a month," and that they could keep it an indefinite time; that it would keep all right for three, six, nine or twelve months, and it would be all right. It was agreed that a temperature of from 16° to 20° would be satisfactory. Mr. Spencer admitted that he made the storage rate with the plaintiffs, and that he charged him half a cent a pound, which entitled him to a freezing temperature. Other witnesses testified that a freezing temperature in the "cold storage" business was a temperature under 20°. It was further shown that the words "cold storage" have a definite trade meaning and include goods taken in cold storage and "freezing"; that the business is known as the "cold storage and refrigerating business"; that the price charged regulates the degree of temperature. This contract was made on the day of the arrival of the goods, and the poultry was immediately stored in the warehouse of Linde & Co. Several days later they sent to the store of the plaintiffs a receipt acknowledging receipt of the poultry "on cold storage." About two weeks after the goods were placed in storage a portion was withdrawn for sale. When examined it was found to be frozen on the exterior, but on the interior it was soft, and the poultry was tainted and unsalable. A portion of it was sold and the balance was given to the dump cart. It was proved that goods on cold storage, of the character of plaintiffs' poultry, kept at a temperature of from 16° to 20° if sound when put in, would keep from three to five years, and that this poultry, during the period when it was on storage, must have been kept at a temperature not below 28°.

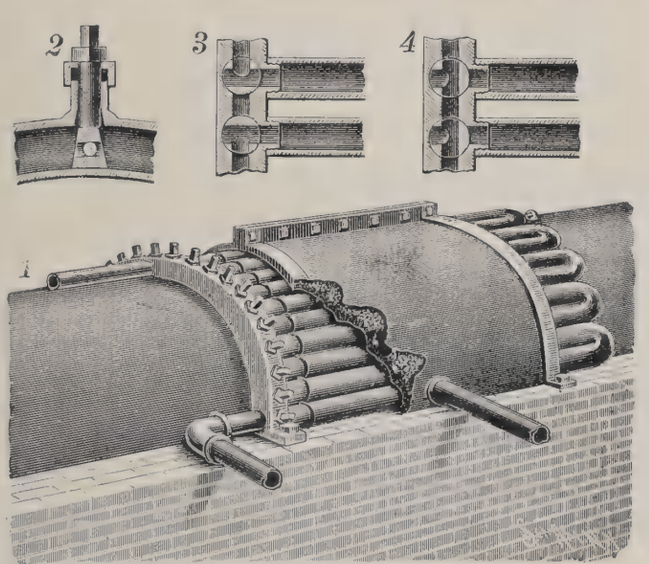
All the successive steps in the litigation were decided in favor of the plaintiffs, Stege & Behrman, the decision of the Court of Appeals being an affirmation of the judgments of the lower courts against Linde & Co. for a total sum, covering the loss, with interest and costs, an amount exceeding $5,000.

The decision is important to managers of cold storage plants in various ways. In the first place, it give a definition for terms used in the commercial cold storage business; it fixes beyond question the liability of cold storage warehouses to maintain a temperature sufficient to preserve the goods placed "on cold storage"—in other words, holds the cold storage warehouse to a compliance with the definite meaning thus given the terms employed in conversation on this subject; and further gives validity to a verbal contract over a subsequent effort on the part of a cold storage company to modify its liability by the wording of its written or printed receipt. In short, the accepting of perishable goods, in good condition, "on cold storage," implies a guarantee by the cold storage company against their loss through imperfect conditions of temperature, and in case of such loss holds the warehouse liable for damages.



TO COOL WATER IN MAINS.

An improvement by means of which the water carried in main service pipes, for use in cities or towns, may be cooled during its passage to be fit for drinking in warm weather, without the addition of ice, forms the subject of the accompanying illustration. It has been patented by Mr. Arthur B. Wood, of Port Byron, N.Y. As shown in Fig. 1, the water main is supported upon a suitable foundation, and lying close to its top are cooling coils connected by a coupling to suitable nipples extending out from a heading, which is divided into a series of



WOOD'S REFRIGERATOR FOR WATER MAINS.

valve chambers having channels communicating with each other, and right angle channels leading into the coils. Fig. 2 is a detail view of one of the valves, a three-way valve having a bottom fitting on the base of the heading, and an outwardly extending stem with squared end and screw threaded portion on which is a binding nut. The valves are opposite the ends of each pipe, to turn on or cut off the refrigerating material, Fig. 3 being a section through the end of two pipes and the valves, and Fig. 4 being a similar view showing the valves turned to cut off the sections. The inlet pipe through which the refrigerating material is forced from any suitable source of supply is connected with the heading opposite the top coils, the discharge pipe leading therefrom at its lowest portion. The coils are held in position by a top casing, made in flanged segments which can be readily placed in position or removed, the inclosed chamber formed by the casing and the water main to be filled with brine or cold air introduced by a pipe at one side and discharged by a pipe leading from the opposite side. The chambers are preferably covered with asbestos, sawdust or other non-conductor of heat. The sectional construction permits the ready removal of any coil, should it become rusted or stopped up, without interfering with the working of the system, the valves being turned to admit the refrigerating material only to the coils desired. In operation, it is designed to force anhydrous ammonia or other suitable refrigerating material into the heading and through the cooling coils, surrounding the top of the main for a short distance only at a convenient point for cooling the water for a certain district or town, the apparatus being duplicated as required when an extended territory is to be covered.

Colonel Rafael G. Acosta, Mexican consul at Kansas City, Mo., states officially that the governor of the state of Sinaloa, Mexico, has issued a proclamation offering a premium of $3,000 cash to any person or company that will establish in the city of Culiacan, capital of the state, an ice factory of sufficient capacity to satisfy the demands of the city, says a Kansas City paper. The place has 12,000 inhabitants. The terms offered by the governor of the Mexican state are enough to make a colony of ice men start at once to Mexico. The only requirement is that the machinery shall be new and first-class, and that it shall supply the demand for at least three years, and that the price of the ice shall not be more than 4½c. per pound, or $4.50 per hundred. The factory would enjoy for fifteen years exemption from all state, district and municipal taxes.

The production of show pieces of ice with flowers and fruit frozen in them is getting to be very popular with northern ice factories, who provide them for their customers. They are very attractive, certainly, and if paid for are well enough; but they are apt to become a nuisance and a source of expense to ice makers, unless the inflexible rule is adopted to make the customer pay for them, as for all other ice supplies.

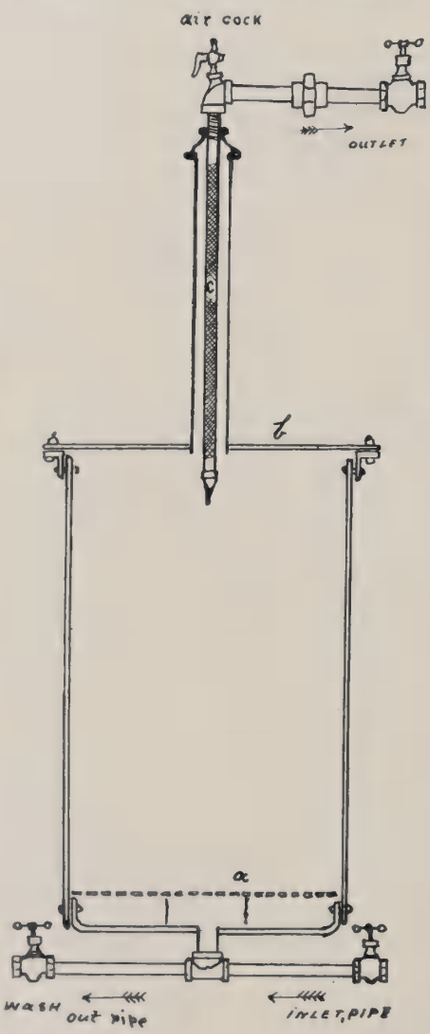
Written for ICE AND REFRIGERATION.]

HOW TO MAKE A FILTER.

THE FILTER AS I HAVE FOUND IT, AND AS IT SHOULD BE — HOW TO CONSTRUCT ONE — HOW TO TEST WATERS — A PRACTICAL MAN'S IDEAS.

By F. S. ALLINDER, M. E.

A good filter is an important feature of all ice machines: and I know by many years' experience that nearly all factories have the same trouble I have had, since very few have made any improvements in this important part of the plant. I find that no matter how careful the engineer may be in packing his filter, there will be some settling of the charcoal, if heavily loaded with gravel or sand to keep it from floating; and even then any sudden or continuous running of the water, such as filling extra cans, will cause the fine coal or dust to carry over to the cans, making black ice, or cutting grooves up through the coal, allowing the water to pass through so small an amount of coal as to do no good as a filter. I have found it the general practice to use sacks, blankets and felt coverings to keep the coal from floating over, all of which soon becomes foul and rotten, while the sand and gravel only take up space and do not do anything toward absorbing mineral or carbonate matters from the water.



My method is plain, requiring little or no change in the majority of filters in use at present, but at the same time increasing their capacity nearly one-fourth by leaving out the sand and gravel. I first have a good-fitting perforated false bottom *a*, with sufficient supports to keep the center from being pressed down by the weight of coal while filling. Use bone charcoal, if you can get it; if not, maple wood charcoal will do. The coal should be well washed before being put into the filter, and the best way to do this is to make a box four feet square by eighteen inches deep. Get enough machinery iron wire cloth, No. 2 mesh, made from No. 11 wire, to cover the bottom; set box on a pair of trestles; then put in the coal; wash until the water runs off clear, and take out and put into filter loosely. Repeat until the filter is even full; then put on the head, using no gravel or cloths over it. Bolt the head on. Screw a piece of 2½-inch pipe, 24 inches long, into top head *b*; get a 1¼-inch drive-well point, *C*, covered with No. 60 wire gauze. Cut thread long enough to screw through 2½-inch by 1¼-inch reducing socket far enough to make connection to put on a T, leaving small air cock in to allow the air to escape while filter is filling. Then insert the well point into the 2½-inch pipe, and screw down tight. Then your filter is ready to connect up as before.

This filter will not clog up, and will run clear water at the first start off. It is a great mistake to run filters too long, where the boiler power is limited, as the hard firing burns the foreign matter in the water, and the burnt odor is carried over in the steam to the condenser. Then, too, the filter takes it up until it becomes so charged that it ceases to act as an absorbent any longer; and this burnt smell passes over with the water to the cans to be frozen. Here is where the public cry "chemicals and ammonia" in the ice. The same odor and taste would be found in your tea or coffee if the tea kettle is let boil dry, and then filled up while hot. A clean filter is the ice man's remedy; a careful watching of the tea kettle is the salvation of a good cup of tea or coffee; then there will be no cry of chemicals and ammonia.

As a good test for distilled water for organic matter, use four to six drops of permanganate of potassium in one-half a glass of water. The longer it retains its pink color, the purer the water. If it turns straw color in a short time, it's no good, and the reboiler or filter should be looked after at once. For chlorides, use a solution of nitrate of silver; for sulphates, use chloride of barium. These can be had at any drug store. Your ammonia test you can get of the firm you buy your ammonia from, by asking for it.

While speaking about water, if you will take a teaspoonful of common baking soda to one gallon of distilled water, using a small sponge to wash the parts affected with prickly heat, the engineer and his help will not suffer so much during the hot months, when an ice factory is not as cool as its name implies.

GAS IN REFRIGERATION.

Mr. F. P. Striker, a mechanical engineer, is engaged in utilizing the pressure of natural gas (about 500 pounds per square inch) for the simultaneous production of power and refrigeration. The gas, as it leaves the well, by virtue of its pressure, is made to propel an engine, and a refrigeration equivalent to the labor so performed is produced at the same time. It is proposed to erect a plant having a capacity of 1,500 horse power for manufacturing purposes and making 300 tons of ice daily.

The principles involved in this enterprise appear to be a special application of those elucidated in the article by Prof. J. E. Siebel on "The Ice Machine of the Future," and described in ICE AND REFRIGERATION in July issue, at page 33. The author of that article, moreover, claims that several years ago he entertained a correspondence with a gentleman in the Findlay, Ohio, gas region, with a view to realizing the ideas now promulgated by Mr. Striker.

EVERY real good refrigerator should have a separate, tight compartment for butter and milk.

MOTIVE POWER UTILIZED FOR REFRIGERATION.

VICTOR POPP GERMAN PATENT, 51,740.

The process consists in taking compressed air out of a main conduit and using the same first in the cylinder of an engine, as motive power, and having said engine emitting the air into a condenser, out of which it will be drawn in by the same engine to be compressed again to be returned into the main conduit for further utilization. By means of the inlet valve *d*, Fig. 1, the compressed air is conducted in the working cylinder *d*, of the engine, and serves at first as motive power to the shaft *r*, the said shaft being provided with one or more fly wheels, instrumental in compressing in a second cylinder the cold air drawn in out of the condenser *B* (Fig 3) by means of the valve *n* and the pipe *m*, communicating with *B*. Meanwhile the air compressed in the cylinder *a* escapes through the outlet valve *e* and pipe *l* into the condenser *B*. Through a small pipe *a*, branched off at the bottom of the cylinder *G*, air is conducted upon the opposite portion in order to hold the sliding valve *e* tightly to its face, and the pipe *g* enters in such a way as to relieve the piston *f* as soon as the outlet sliding valve *e* starts to move.

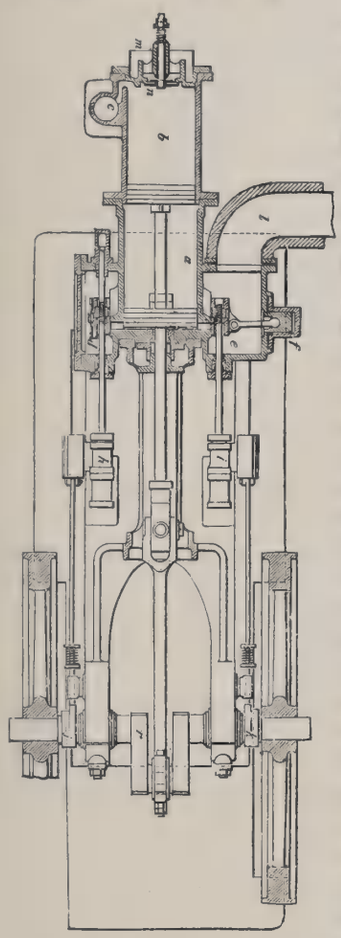


FIG. 1.

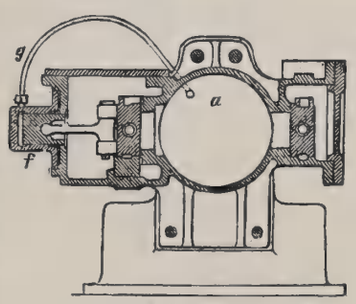


FIG. 2.

The two sliding valves *d* and *e* are operated by means of the pistons of small cylinders *h* and *i*, said pistons being regulated by sliding discs *j* and *k* on the driving shaft *r*.

The cylinder *c*, as arranged with an adjustable piston on the compressing cylinder, is intended to regulate the volume of the dead space in the compressing cylinder. The condenser *B* is built with double walls, the cold compressed air circulating in the same, as indicated by the arrows, and completely surrounding the condensing chambers. The air in the condensing chambers may be removed by opening the valves *F*.

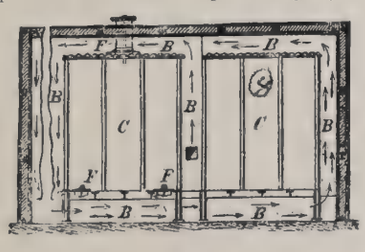


FIG. 3.

ICE IN PIONEER DAYS.

People who have to endure summer weather in these modern days don't know what a comparative luxury life nowadays is, as against the privations of the pioneer days in California, says the Sacramento *Bee*. It is relatively easy to keep cool in these days, with ice retailing at half a cent a pound, and sherry cobblers and hock punches served luxuriously at a bit, or even a dime a draught. It was not so in the olden days, when ice was brought to San Francisco in ships from Boston, and when the Sacramento supply was dispatched from the bay by river boats. It often happened that the supply of Boston ice was short. The ship would be becalmed or meet with delay on the way out in some other way, and then an ice famine would set in. In those cases ice or snow was brought to this city from high up in the Sierras by mule teams, and often netted fortunes to those who transported it. In a pinch a dollar a pound was freely paid.

"Baldy" Hamilton, the genial stage owner, is one of California's pioneers, and in early days he was largely engaged in heavy teaming to the mountains. The Boston ice supply had given out, and "Baldy" saw the chance to turn a dollar. He loaded a train of wagons high up in the Sierras with snow laid in sawdust and covered deep with green boughs. A guard of twenty men accompanied the caravan, for this was in September, 1851, and the Indians were not as docile as they are now. At every spring or creek along the route the wagons were wet down, and in this way it was possible to largely prevent the precious train of snow from melting.

News of Hamilton's approach with his comforting load reached town. It was scorching hot, and the big drinking places began to vie to get a monopoly of the welcome snow. One of them dispatched a courier up as far as Shingles to negotiate for all the snow Hamilton had. He offered seventy-five cents a pound for the snow. Hamilton knew that there was absolutely no ice in the market, and remembered that he once before sold a cargo of mountain ice for a dollar a pound. He scorned the offer.

It was late the next night when "Baldy" reached town. He put up the wagon train at a stable, and walking over to the principal saloon, bantered the bartender by calling for eighteen or twenty sherry cobblers, expecting, of course, to be met with the announcement that there was no ice in town. To his amazement, however, the barkeeper lifted up a fifty-pound block of ice, and proceeded to fill the order in the most unconcerned way.

The ship from Boston had arrived the day before, and snow wasn't in it against ice.

"That ship made a difference of $20,000 with me," said the veteran stage man, as he mopped the sweat from his expansive brow.

As INDICATIVE of the enormous grape crop now being harvested in Michigan it is stated that a basket and fruit package factory at Decatur, Ala., is sending to Michigan fifteen car loads of baskets per week.

THE Kansas City aldermen are still laboring with the question whether they will grant a franchise for pipe line refrigeration in that city. "Great bodies move slowly," we are told.



The removal of the German embargo on pork (which action of Germany has been followed by Denmark) is conceded by the packers to be a big thing for the trade, although the high duty still stands in Germany. The exports of hog products from America reached "high water mark" in 1881, when they amounted to $105,000,000, of which Germany took $11,000,000. The exports then declined steadily to $57,000,000 in 1886, but have since, with ups and downs, recovered to $85,000,000 for the fiscal year ending June 30, 1891. Germany began her prohibitive measures in 1880, when salt meats were interdicted; later bacon and hams were shut out, and even forbidden carriage privileges across the empire. The new meat inspection law and the present prospective scarcity of food in Europe, are, no doubt, the operating causes of the removal of the embargo. The removal of the restrictions ought to add $50,000,000 annually to the future business of American exporting pork packers.

R. W. Turner, American consul at Cadiz, Spain, has recently sent to the state department some valuable suggestions for the benefit of meat exporters, citing the experience of a Spanish importer of his acquaintance. The goods were entirely satisfactory, but the terms of payment and careless methods of following shipping directions did much to discourage, if not to prohibit, further business after a couple of trials had been made. The first invoice was shipped *via* England, the consignee being drawn on when the goods were shipped, requiring payment some thirty to forty days before the goods arrived in Spain. The terms of payment for the second invoice were agreed upon before shipment (thirty days' sight) and the goods ordered by the buyer shipped direct to Cadiz by a new line then just established. These shipping directions, however, were ignored, and the goods again shipped *via* England, and were delayed some sixty days in trans-shipment, during which time an increased duty became operative, causing a serious loss to the importer, who was besides disgusted by the fact that the draft for payment, contrary to the agreement, was attached to the bill of lading, requiring payment in Paris almost as soon as presented, in order to get possession of the bill of lading and the goods. The consul suggests that packers, as well as other shippers of American goods (which are very popular in Spain), would do better to establish agents there, by whom, there is little doubt, a profitable business in American meats and manufactures could be rapidly built up.

The above incident is mentioned to show, first, that great care should be taken to follow instructions in filling orders received, both as to the route of shipment and the method of settling the account; second, that agents who go there to do business should go fully empowered to arrange and smooth away all like difficulties that may be presented for consideration when business is solicited.

A cable from Hamburg, Germany, says: "A syndicate of capitalists propose to build large abattoirs at Chicago, so that Germany may control the importation of American pork." "Important—if true." They will find enough work to keep them busy, surely.

PACKING HOUSE NOTES.

——The new addition to the Iowa City (Iowa) packing house is now ready for use.

——Denver people are said to be interested in a new packing house at Salina, Kan.

——The new Ryan packing house, Dubuque, Iowa, is 145×80 feet, five stories high.

——The packing house at Ft. Worth, Tex., has begun operations, with all its new machinery.

——W. E. Raht and others will build a packing house on the Market street river front, at Chattanooga, Tenn.

——Work on the building of the new Waterloo, Iowa, packing house is about finished, and machinery is now arriving.

——The Sioux City Dressed Beef Co. has completed arrangements for adding a sheep slaughtering department to its plant.

——A controlling interest in the Lincoln (Neb.) stock yards has been sold to a Boston syndicate, represented by Charles H. North.

——The Allerton packing house at St. George, Mo., are changing their system of refrigeration from the direct expansion to the brine system.

——Swift & Co. have completed an addition to their packing house at Kansas City, Kan., which will give employment to 1,000 additional hands.

——The East St. Louis Packing Co., East St. Louis, Ill., has been licensed to incorporate with a capital of $300,000; incorporators, Henry Crossman, Noble B. Judah and Arthur A. Bliss.

——Walters, Archer & Walters, wholesale butchers, of Denver, have been incorporated as the "Standard Meat and Live Stock Co."; capital $225,000. They contemplate erecting a packing house in 1892.

——The Morrell packing house, Ottumwa, Iowa, has been shut down until the repairs and improvements are completed. When the establishment resumes business the working force will be largely increased.

——The Atlantic Packing Co., Atlantic, Iowa, has filed articles of incorporation; directors, A. Nachman, F. Hill, George Allison, Hyman Sultan, Leonard Haas, Paul Shiel and O. H. Bogart; capital stock, $10,000.

——A Denver paper says: "The new pork packing establishment, to be built, will cost $15,000, and will handle 10,000 hogs per year. The process employed will be a new one, being the invention of J. R. Palmore, of 1747 Champa street, who is at the head of the project."

——The Chicago Packing Co., Nebraska City, Neb., September 1 began making ice. It was twelve inches thick, and the manager proposes to manufacture a new cake each day with an advertisement in the center, which he will put on exhibition at the exposition. The company will make its own ice in the future.

——The new packing house of Cassidy & Mason, Mankato, Minn. is to be 106×62 feet, with two wings 20×30 and 12×16 respectively, the main building to be three stories high. The cold storage room will be in the main building, with room for a charge of 2,000 tons of ice; the cooling room will have two compartments; capacity of the house, 200 hogs and fifty cattle daily.

——A project to establish a huge abattoir at the Claremont stock yards, near Baltimore, has been submitted to the investors of that city. The Union Stock Yards Co., which owns the yards at both Calverton and Claremont, proposes to concentrate all its live stock business at the latter place, and the Claremont Abattoir Co., with a capital of $300,000, is to be organized for the purpose of erecting an abattoir and refrigerating plant, to be operated on the co-operative plan. The amount of live stock handled at both yards annually amounts in round numbers to 220,000 cattle, 10,000 calves, 415,000 sheep and 900,000 hogs.

THE *Medical Times* says that a saucerful of shaved ice can be kept in good condition for twenty-four hours, even when the thermometer is at ninety degrees; and this is the way to do it: "Put the saucer containing the ice in a soup plate and cover with another. Place the soup plates thus arranged on a good heavy pillow, and cover with another pillow, pressing the pillows so that the plates are completely imbedded in them. An old jack plane set deep is a most excellent thing with which to shave ice. It should be turned bottom upward, and the ice shaved backward and forward over the cutter."

ICE AND REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION AND THE TEXAS ICE MANUFACTURERS ASSOCIATION.

·.· OCTOBER, 1891 ·.·

SUBSCRIPTION PRICE, $2.00 PER ANNUM.

H. S. RICH & CO.
PUBLISHERS,
177 La Salle St., Cor. Monroe, CHICAGO.
206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

Entered according to act of Congress, in the year 1891, by H. S. RICH & CO., in the Office of the Librarian of Congress, at Washington, D. C.

SOUTH-WEST ICE MFRS. ASSOCIATION.

[OFFICIAL.]

DESIGNATING OFFICIAL ORGAN.

We hereby designate and confirm the journal ICE AND REFRIGERATION, published by H. S. Rich & Co., 177 La Salle St., Chicago, as the regular and only official organ of the South-West Ice Manufacturers Association.

W. O. CALDWELL,
Pres. South-West Ice Mfrs. Ass'n.

Attest: C. M. GAY,
Sec'y.

A FEW MORE GOOD WORDS.

ICE AND REFRIGERATION acknowledges the continued receipt of kind words of approval by readers of the efforts of the publishers to produce a trade journal which shall merit all of the most generous patronage which has been bestowed upon it since the appearance of the first number, in July last. We assure our readers that these expressions are very gratifying to us. We also thank the writers for the many kindly suggestions offered for the further improvement of the paper; some of which have been very valuable indeed, and will be of assistance to us in enhancing the worth of the paper to the reader and advertising patrons alike. All of the suggestions will be developed as rapidly as possible.

[O. G. WESTON, Engineer, Augusta, Ga.]

I think ICE AND REFRIGERATION a suitable companion for all engineers of ice machines.

[A. J. DEXTER, Manufacturer, and of Alexander, Beach & Co., Cold Storage and Produce, Whitewater, Wis.]

Your paper, ICE AND REFRIGERATION, should be liberally subscribed for by all interested in refrigeration.

[A. L. CANFIELD, Engineer, St. Louis.]

I was handed a copy of ICE AND REFRIGERATION by a friend in an ice factory, and am so well pleased with it that I inclose money for subscription.

[W. W. BAILEY, Sheffield, Ala.]

A few days ago a friend showed me copies of ICE AND REFRIGERATION, and handed me a subscription blank. I was delighted to know that such a publication is in the market, as I have tried many times to learn of something of the kind. This is my second year in the ice business, and I am confident I shall be much interested in your valuable publication.

[GEO. H. WHITESIDE, Apalachicola, Fla.]

The numbers of ICE AND REFRIGERATION received are very valuable, and future numbers will undoubtedly impart more valuable information to the owners of ice making plants.

[WESTERN MINERAL WOOL CO., St. Louis.]

We have heard more favorable comment upon your journal, ICE AND REFRIGERATION, than of any trade journal we have ever known.

[MOESER ICE MFG. CO., Topeka, Kan.]

Inclosed find $2 to pay for ICE AND REFRIGERATION for one year; and I must say that we are well pleased with it.

[J. A. DILLON, Tecumseh, Neb.]

Inclosed find postoffice note for $2, in payment of my subscription. I am much pleased with ICE AND REFRIGERATION.

[L. FOUTREL, Nuevo Laredo, Mexico.]

The three numbers of ICE AND REFRIGERATION have been received. I am sorry to note the death of my old friend, David Boyle, whom I knew in Jefferson, Tex., when there was more work than money in the ice business. ICE AND REFRIGERATION is just what every ice man needs, and the ice man who does not subscribe for it is, I think, behind the times. How happy I would have been to have had such a paper to read in 1867, when I first learned to make ice in San Antonio, Tex., with a Carré machine. Consider me a lifelong subscriber.

[O. H. TUCKER, Genl. Supt. Northern S. S. Co., Cleveland.]

Your work is one of decided merit in every way.

[STUART ST. CLAIR, Genl. Mgr. York Mfg. Co., Ltd., York, Pa.]

Though late about it, allow me to offer my congratulations for the grand success you are having, and are sure to have, in the publication of ICE AND REFRIGERATION. It has been a long felt want, an organ that would enable those engaged in a business that will occupy a prominent place in this country, to exchange views and glean ideas. A long experience in this business makes me an appreciative reader, and with your permission and a little time, an occasional correspondent. I wish you success.

[J. SCHUEHLE, Manufacturer, San Antonio, Tex.]

I consider your journal of such importance to the trade that I deem it my duty to get all the subscribers I can for you.

[SEATTLE AUTOMATIC REFRIGERATING CO., Seattle, Wash.]

Your September number is a jewel, and of priceless value to all interested.

[CENTRAL UNION TRANSFER AND STORAGE CO., Rochester, N. Y.]

We think highly of ICE AND REFRIGERATION in our office, and find it to fill a want long felt.

[J. M. TOUNE, Manager, TRABUE ICE AND COLD STORAGE CO., Punta Gorda, Fla.]

Please find inclosed order for ICE AND REFRIGERATION. And I would say one can get many a good hint on conducting and manufacturing ice from the many able articles it contains.

[W. O. CALDWELL, President SOUTHWEST ICE MANUFACTURERS' ASSOCIATION, Fort Smith, Ark.]

Mr. Gay (secretary) and myself are very much pleased with your September issue; because, besides the priceless information generally contained in every issue to all ice men, it gives our new association a prestige and standing with the fraternity that it probably would have taken a good while for us to establish. We gratefully recognize the good offices ICE AND REFRIGERATION has done for us, and, as its executive officer, I feel no hesitancy in saying that you will always have a warm friend in the "Southwest Ice Manufacturers' Association." Wishing you unbounded success, I am yours to command.

[H. BACON SMITH, CLARKSVILLE ICE AND COAL CO., Clarksville, Tenn.]

Inclosed find check for $4 (for two subscriptions). We are more than pleased with "I. & R."

[S. W. CURRIDEN, Treas. HYGIENIC ICE CO., Washington, D. C.]

With this find our subscription for ICE AND REFRIGERATION, which has not been sent to you sooner because of oversight. The millennium has not come, but it is on its way. So with the universal use in large cities of artificial ice, free from the taint of disease and filth that much of the natural ice has to a greater or less degree. Your publication promises much of needed help to the artificial ice business—a business which is in process of development, in which much is to be learned, but the outcome will be, as with electric lighting, success.

EDISON says by that next winter he will have perfected an electric reflector which will melt snow as it falls. As he resides in the heart of the great American blizzard belt, and has frequently been snowed under a good part of the winter, it is not surprising that his inventive mind has been turned in this direction.

LOCAL ORGANIZATIONS.

The example set by the Texas and by the Florida Ice Manufacturers' Associations, by the Southern Ice Exchange, and by the Southwestern Ice Manufacturers' Association, in forming state and district ice manufacturers' associations, ICE AND REFRIGERATION hopes soon to see followed by ice dealers in all the states of the Union. The members of these existing organizations are very enthusiastic over the results already attained, though the associations are young as yet; and they have already begun to talk of a national organization and meeting. This organization also ICE AND REFRIGERATION would like to see; and it will undoubtedly come in due time. But, meantime, even greater benefit would result to the trade generally by the formation of county or congressional district associations, which lead up, step by step, to the state and national organizations. One of the common mistakes of the higher associations is that they attempt to do too much in a short time. A large body is always unwieldy; and in the end, if undertaken without the previous or contemporary work of local organizations, a national gathering is likely to amount to but little more than a pleasant meeting of representatives of the trade, with a "commers" or a "pow-wow," a banquet, some interesting papers and lots of good feeling, but with little substantial benefit to the trade.

The minor, or local, organizations should come first. These in reality do the work designed to be done by a higher organization. In a national association especially, the big, the large, the lesser and the small, are all mixed up together, and it is difficult to harmonize the varied interests represented—indeed it is practically impossible to do so in so large a body as the ice dealers of this country, both large and small, would make, attempting to reconcile by the action of one great body the conflicting interests in all localities of this broad land.

Locally, however, it is different. In forming such associations, all there is to contend with is a little human nature. Every one naturally wants to get the advantage of his neighbor. There is, probably, business enough for all. If there isn't, that doesn't cut any figure in the organization. All there is to do is to come together in the proper spirit, and agree to get a fair price for the business handled. It makes little difference how small an amount of business there is, for it is possible through intelligent organization to get a fair price or a fair profit out of the business that does present itself. This is the result.

Now as to means. A big state or national association cannot reach the source of the trouble, but a small association can. For instance, here is a little town of 4,000 to 10,000 people. It has two or three ice dealers. Eight, ten or twenty miles away there is another town where there are one or two dealers; and ten or twenty miles in another direction, another like town. What is there to prevent these several dealers from coming together and talking over that which comes before them in the ordinary course of business, and agreeing upon certain details? Each one of these dealers can tell about something that the others have done which has injured his business. It is curious how men will discover when they meet in such a gathering that it is always the "other fellow" who does all the mischief! Jones will tell how he started the season with a fair and profitable price list, but the "other fellow" began cutting. Then Smith, from the next town, says the "other fellow" in his town did the same, and, further, that the other "other fellow," from the next town, invaded his town and "knocked the spots off" both price lists, and "upset the whole business" in both towns or the whole neighborhood. Each one of the gathering can tell a cut-throat story—they have all been engaged in the same business—dreadful tales about the "other fellow"; while in fact, each one is himself the "other fellow." After this there will come about a pleasanter feeling; they will soon see that they are all in the same boat, and by and by a little understanding is had between them, which works quite a change in the profits of the year's business. This is the local organization—the nucleus for a successful state organization, for these men have solved the immediate problems of their own localities, and are in a position, through experience, to act harmoniously on a large scale. Let the states be honeycombed with just such associations. In one county or district there may be an organization of eight or ten members. They can meet with and become a part of the organization of an adjacent district, and so all in the end become cemented together. It will be astonishing to see in how short a time an entire state or section of the United States will come together in this way. It is also remarkable that the talk about what the other fellow is doing soon dies out. They all mutually agree that they have been bad fellows in the past, and are going to be good in the future; and as soon as they find out that it pays to be good, they are good. It is a fact that has been proved beyond question by other trades, that a permanent and useful state or national organization cannot be formed where the members cannot agree or organize locally. A single local or neighborhood quarrel can knock a state organization all to pieces and so demoralize the trade that it will take years to reorganize it. There must be a local organization in all sections before there can be a certainty of and having a state or a national organization that is worth fooling with.

NEWSPAPER COMMENTS.

It has been interesting to note, during the spring and summer past, the comments of the daily and weekly newspaper press on the ice machine; and it is worthy of remark that no scepticism regarding its value or the merit of its product has yet varied the monotony of the universal commendation and approval of an invention, which, five years ago, not one writer for the press in a hundred had apparently ever heard of, and which few of them to this day have actually seen. In general, they are overcredulous of its capabilities, however; for nearly all of these enthusiastic commentators see in the ice machine the immediate and utter annihilation of the ice cutter of their own lakes and streams.

"The high price of ice last year," says a Louisville paper, "has stimulated the production of the artificial article to such an extent that there would seem to be small chance of ice famines and exorbitant prices in the future. It has already become the chief resource of western cities for this necessity of the sweltering season." Yet this writer would be puzzled to name one western city of prominence north of Mason and Dixon's line, that is supplied wholly by the ice factory. Indeed, ice factories North are the exception rather than the rule as yet, though, of course, it is true the attention of investors is being drawn to the business to a degree.

It sounds particularly astute, too, in the rural organ to remark that: "The shortness of the ice crop a year ago last winter, which was for a time accounted a bonanza to the producers and dealers, has, as a matter of fact, proved very disastrous to them; for the scarcity of ice, and the fabulous prices charged for it, stimulated the manufacture of artificial ice to such a degree that it continues in active competition with natural ice." But here again the editor would find it difficult to tell us just where the "disaster" occurred. Generally speaking, the ice machine has not as yet come into active competition with natural ice, except in a minor degree in the great cities, and in these cities it does not control the price of ice by any means, but rather takes a second place to the natural ice, which sometimes is sold at a lower price than the manufactured ice. Here and there, as, perhaps, at Louisville, where manufactured ice sold at thirty cents per hundredweight this year, in comparison with eighty cents for a very short crop of natural ice the year before, the introduction of the ice machine may be said to have worked a "revolution" in the ice business; but such localities are far more rare than the reader of the country press would imagine at first blush; and it is likely that it will be still some years before the condition now so glowingly pictured as common will obtain generally throughout the country. It is true, "the inventive genius of man abhors a vacuum in the necessaries of life, with their consequent high prices, and proceeds to apply a regulator," but nature also abhors a vacuum; and one year with another does her full duty to her children, if they will in like manner do their duty to themselves.

The country press, too, is unfortunately prone to pick up and fondle theories, fads and ultra "goody-goody" effusions which cranks innumerable pour in upon the columns of the city press. The world is full of men to whom nothing is quite good enough—who could have made the world and all it contains a great deal better if they had just been given a chance at its creation; but it is the more remarkable how many sensible and thoughtful men seem to fall into line with their theories or approve of them through sheer thoughtlessness and inaccurate thinking. On what other hypothesis can be explained the ebullition of the editor at Waukesha, Wis., who says: "A good many signs point to a belief that the days of gathering stores of ice from filthy ponds and rivers are about numbered"; adding that, "refrigerating and artificial ice making machinery, by the use of which comparatively pure ice may be had, will, beyond much doubt, before long take away the employment of the ice cutter." This from a Waukesha man, in the very heart of the finest natural ice country of the Northwest, is equal to a Milwaukee man's saying, "the beer from Oshkosh will before long take away the occupation of the brewers of Milwaukee!" Unquestionably manufactured ice has come to stay, and more and more of it will be made annually in the years to come, but all talk of its taking immediate control of the ice trade of the North because some cranks assert that some natural ice is impure is preposterous.

Equally so is the same gentleman's prophecy that, "It now only remains for some fortunate inventor to bring out a machine which shall be cheap in price, and which will operate economically in making small quantities of ice, to knock the bottom out of ponds and rivers, so far as providing the cooling solid is concerned." Such a machine has been brought out, and yet it no more affects the ice trade than the making of "Johnny's pants" at home by the thrifty housewife affects the clothing trade. The tendency of the times is to more and more completely supplant household manufacture of every kind because the latter is always to a certain extent uneconomical. Ice certainly will never be made in that way in any considerable quantity any more than will flour, or provisions, or cloth, or clothing, etc., be made at home. Man does not progress crab-wise in these days. The modern tendency is to concentration in productive effort, not to diffusion among individuals. The spinning wheel and the hand loom of our mothers is gone for all time, and with it the necessity or desire to perpetuate the family system of manufacture common to pioneer times in this and all new countries.

THE trade journal has become an important factor in modern business. Its influence is recognized and its special value indorsed by every branch of our many and diversified industries. It is specific—hence its value, says *Age of Steel*. It is not used for a wrapper for soap or sausage meat, nor used by the hired girl to clean a lamp or curl her hair. It belongs to the office and the workshop, and is as exclusively the property of what it represents, as is a magazine of fashions in a millinery store, or a list of drugs to a druggist. The daily press can never assume its office nor its influence. It is restricted to business, and in its particular line has a business claim on the fraternity it represents. Its advertisements are not waste paper, and they are placed just where they are most likely to secure attention and patronage. The modern business man is aware of this fact, and in proportion to his sagacity he rates the business value of the trade journal.

THE Connecticut state board of health has declared the ice from Rimmon pond, Naugatuck river, twenty miles below Waterbury, the ice from which was at one time sold at Bridgeport, to be impure and unfit for use. The investigation of the quality of the ice grew out of a lawsuit against the city of Waterbury for the pollution of Naugatuck river. The report of the board says that the river is in very bad condition as a result of the sewage therein, and that notwithstanding the distance between the city and the pond, the latter is becoming polluted to an alarming extent. Acting on this report, the health officers of Bridgeport, which had largely been supplied with ice from Rimmon pond, has prohibited the sale of that ice. The dealers, however, claim that no Rimmon pond ice has been brought by them to Bridgeport in the past two years, although they have some old ice in storage there.

A PEORIA paper "stops the press" to record the fact that: "An ice wagon broke down on Main street yesterday and delayed the street cars." But suppose the street cars had broken down and delayed the ice wagon! "Oh, well, that's different."

THE greatest cold officially reported in the United States for twenty years is 63 deg. below zero F., at Poplar river, Mont., in 1885. Since that intense frost no equally low temperature has been made known.

ANSWERS TO CORRESPONDENTS.

RESTORING AMMONIA — TEMPERATURE FOR COLD STORAGE OF FRUITS—TO CALCULATE LOSS OF PRESSURE—BEST ICE MACHINE—MEASUREMENTS, ETC.

[This department of ICE AND REFRIGERATION will be conducted for the benefit of the trade generally, as well as individuals, and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

To the Editor: We would like to have an expert tell us what to do to aqua ammonia to restore it to its original qualities. When it gets so it will not absorb, it registers two degrees stronger at the same temperature than when it was forced into the system sixty days before. Ours is an absorption machine, and the makers of ammonia insist that it is made from pure sulphate. It was 26° when received and fully 28° when drawn off. It usually weakens or wears out from leaks of gas, but this time it is reversed. P. H.

Answer.—Since you do not state the denomination of the degrees which you mention in your letter, we are unable to discern their significance. If we are to judge from your other remarks, your ammonia becomes more concentrated, and this could be readily adjusted by the addition of the proper amount of water, we should judge.

To the Editor: What in your opinion is the best temperature for storing soft shelled fruits, such as grapes, etc.? TH. H.

Answer.—We think that a temperature of about 34° Fahrenheit, is low enough, provided you can keep the storage room dry, and the fruit is not too densely packed.

To the Editor: How can I calculate the loss of pressure of air in a pipe line? C. Z.

Answer.—According to the most recent experiments the loss of pressure in pounds P, can be found after the formula:

$$P = 0.00936 \frac{n^2 l}{d}$$

in which formula d is the diameter of the pipe in inches, l its length in feet and n the velocity in feet per second.

To the Editor: Which is the best kind of ice machine, the one with direct expansion or the brine system? Please inform us through your next issue? CH. L.

Answer.—All we can say is that both systems work satisfactorily wherever we have found them in use, although probably each machine may have some special advantages in certain special cases.

To the Editor: Can you give us the relation between measurements in feet and meter, or inches and centimeter respectively? G. W.

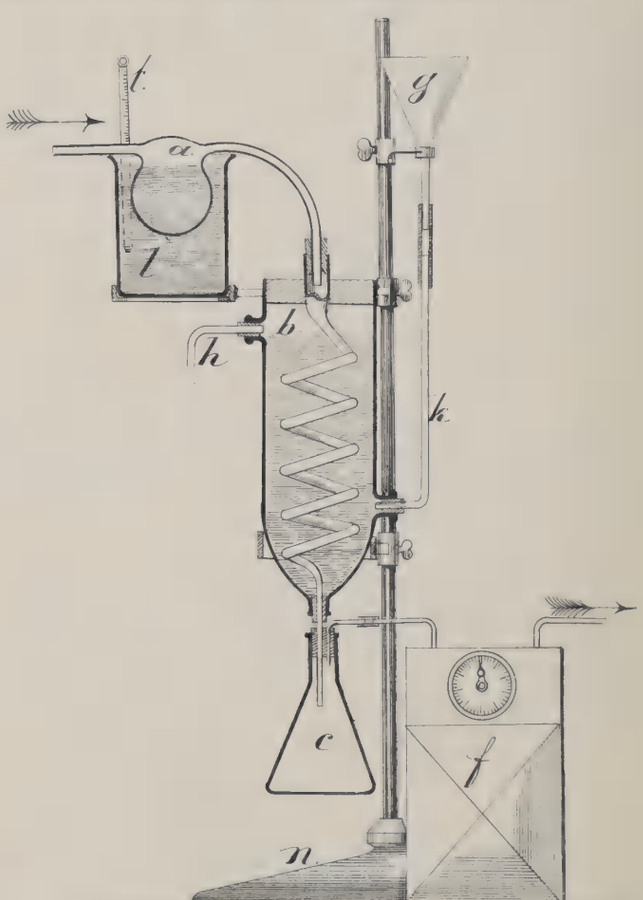
Answer.—One meter equals 100 centimeters, or about 39½ inches. If the round figure 40 is taken, one inch is equal to about 2½ centimeters.

THE BACTERIOLOGICAL EXAMINATION OF AIR.

BY J. E. SIEBEL, DIRECTOR OF THE ZYMOTECHNIC INSTITUTE, CHICAGO.

The various methods which have been recommended for the bacteriological examination of air suffer from several imperfections. Either the quantity of air treated is not in a condition to be correctly measured, or it is uncertain whether all the bacterial germs have been abstracted from the same, or it is a question whether all the germs have been transferred to the nourishing medium, as is the case when sand or cotton has been used for the filtration of the air.

The observations relating to the deposition of bacterial germs with the deposition of atmospherical moisture, recorded in another place of this issue, have led to the construction of a device designed for the bacteriological examination of air which I think is calculated to remedy those defects and to give more exact and more positive results than any one of the other methods hitherto employed. In the execution of this method a known volume of air is saturated with moisture at as high a temperature as is compatible with the non-destruction of the bacterial germs contained therein. The air is carried through a cooling device, by which most of the moisture is caused to subside, taking with it all the germs contained in the air so treated. The moisture or dew condensed on the cooler after being collected is in a very convenient condition for plate cultures with different media and at different temperatures.



Apparatus embodying this principle may be constructed in various ways. The one which is illustrated in the accompanying sketch is so arranged that it can be readily constructed from parts which are always on hand in every laboratory. As will be seen, the air by means of an aspirator (not shown) which may be connected by a gas meter, if it does not measure itself, is drawn over the water contained in the bulb a which is kept at a temperature not exceeding 120° by means of a water bath. Here the air is both warmed and saturated with moisture. On entering the Liebig cooler b, which is kept cool by means of refrigerated water, or better, refrigerated brine, the larger portion of the moisture condenses, and settling on the inside walls of the worm, takes with it the germs of the air, so that the latter leaves the vessel c germ free, as can readily be shown by careful yet simple tests. After sufficient air has passed through, the cooler is inclined in a manner so that the water contained in a (which, as well as the whole apparatus, was previously sterilized) runs through the worm, washing down the moisture which has settled on the

worm. The water thus collecting in *c*, that is, a given portion of the same, may then be used in developing plate cultures as usual, with different media, as well as under different temperatures. If the vessel *a* is sufficiently large, great quantities of air can be passed through in a comparatively short time, and if a gas meter arranged to serve as an exhaust fan is used, the aspirator is of course superfluous.



NATURAL ICE NEWS.

In spite of the predictions of the kickers, who predicted the downfall of the natural ice dealers when they discovered the machine ice on the markets of the great eastern cities, the season in the Maine fields has been an excellent one thus far. The business has felt no "boom" in prices, which have generally been lower than for two years past, but the demand for ice has been active at fairly remunerative prices, and stocks have been generally reduced. The August shipments from the Kennebec were large, so that on September 1, out of 850,000 tons, estimated, in store in April, there remained only about 200,000 tons on hand. Shipments in September still further reduced the stock, and will during the current month, if the weather should be the average of October, so that before snow flies there will be very little ice left in stock. Repairs on storehouses are going on, and a good many new houses, some of them quite large, are in process of erection in anticipation of the cut of the coming winter.

——J. B. Elliott is building an ice house at Clarence, Iowa.

——Several new ice houses will be built at Kokomo, Ind., this fall.

——J. L. Beiler will erect an ice house on Pine street, Indianapolis.

——David D. Addis has begun work on another ice house at Kingston, N. Y.

——A large ice house is to be erected on Seavey's island at Portsmouth, N. H.

——S. Burt will erect ice houses at Mishawaka, Ind., at the mouth of Barbee creek.

——Webster & Co., Buffalo, N. Y., will build a new ice house, 150×250 feet, at Lime lake.

——The Preston Lake Ice Co., Chester, Pa., are going to build a new ice house this fall.

——Extensive repairs are being made on the houses of the Arctic Ice Co., at Orrington, Me.

——L. R. Tull is putting up a large ice house, and will retail ice at Dallas City, Ill., next season.

——Clark & Chapin, of Gardiner, Me., still continue shipments via schooner to Philadelphia.

——The Arctic Ice Co., of Providence, R. I., have been hauling ice from Maine by schooner.

——The Knickerbocker Ice Co. is rebuilding the elevator at Farmingdale, Me., burned last winter.

——Stearns Brothers, ice men, at Amoskeag, N. H., are to enlarge their storage capacity this fall.

——The new Adam Bonacker ice house, on the island near Albany, N.Y., will have a capacity of 10,000 tons.

——W. J. Smith has purchased W. S. Beckner's ice business at Chattanooga, and consolidated it with his own.

——The assessors have lowered the valuation of the Knickerbocker Ice Co.'s possessions at Kingston, N. Y., $5,000.

——Port Byron is shipping ice via rail and river, but still has five large houses in which the stock remains untouched.

——The Forest City Ice Co., of Cleveland, will add several large ice houses to their already large plant at East Tawas, Mich.

——Two ice houses and 15,000 tons of ice, property of the Hollis Bros. Co., Manchester, N. H., were sold by auction, September 19.

——Webster & Son are preparing the ground for another immense ice house to be built on the east bank of the lake at Machias, N. Y.

——The ice business in the "copper country" of Michigan has not been a howling success this season, owing to the cool weather in the "upper lake region."

——The Cascade Ice Co., Colorado Springs, Colo., have two ice houses, 80×130 feet, and will erect three more this season, giving the company storage capacity of 15,000 tons.

——The Rockport Ice Co., Rockland, Me., has sold this season 40,000 tons, their supply falling short of the demand. The company will build another large house to be filled the coming winter.

——Mr. W. A. Cunningham, ice dealer at Anamosa, Iowa, is a candidate for state senator. Mr. C. will "keep tab" on the weather, for it is said it is only a very cold day when an "ice man" gets left.

——The Rockport Ice Co., Rockland, Me., is at work erecting an ice house 60×150 feet, to hold 5,000 tons. It will be built of wood and iron. Other new houses will be built before the cutting season begins.

——The schooner George E. Walcott, September 9, finished loading one of the largest cargoes of ice ever shipped from Bangor, Me. She took 2,831 tons from the Katahdin Ice Co., shipped by Walter K. Shaw and T. J. Stewart & Co., to Philadelphia.

——The Arctic Ice Co., of Newport, R. I., during the hot days of August, had to haul ice from Massachusetts for temporary use over the Old Colony railroad, the entire stock on hand having been exhausted. The company had three schooner loads of ice on the way, but all were badly delayed by the high winds, and a semi-famine of ice lasted for several days.

——An award of $86,500 was recently made by a special commission in favor of the Boston Ice Co. as damages for the taking of its property, at Fresh pond, by the city of Cambridge, Mass. The ice company claimed that it was entitled to about $150,000, but the city placed an estimate of $40,000 on the property. The same commission in the Boston Ice Co.'s case, tried the Fresh Pond Ice Co.'s case last year, and made an award of $102,000, which was accepted.

——The shipments of ice from the Truckee river, at Truckee, Cal., this year have exceeded those of any former year, and the total amount disposed of will amount at the close of the season to about 75,000 tons. The Rocky Run, Floriston and Tahoe Companies are cleaned out and the Mountain will finish this week. The People's Co. will finish in two weeks. One house each at Prosser Creek and Boca has been emptied, and one more house at each place will probably be emptied before the end of the season. The amount to be carried over will not exceed 25,000 tons.

MINOR LEGAL MATTERS.

——The Reliance ice factory, San Antonio, Tex., will be sold by foreclosure proceedings; liabilities, $23,000.

——The Paris (Ky.) Ice Manufacturing Co. has made an assignment to B. F. Graziana, of Covington. The plant was erected last spring by Geo. W. Seiter, of Covington, at a cost of $30,000; liabilities, $15,000.

——John R. Briggs, Coeymans, N. Y., manufacturer of Briggs' patent corrugating elevator plane for reducing ice to an even thickness, and corrugating it upon the upper surface, has begun suit in the United States court against G. A. Birch & Co., for infringing patents on his plane.

——Suit was entered in the United States circuit court, at Philadelphia, September 3, by Robert E. Jenkins, assignee of the Consolidated Ice Machine Co., of Chicago, against the Consumers' Ice Manufacturing Co. to recover $21,000, a balance claimed to be due on ice making machinery constructed at Thirty-first and Walnut streets.

——W. H. Warrington, September 22, offered $66,000 for the Consolidated Ice Machine Co. plant at Chicago. Judge Scales conditionally accepted the bid, and ordered the sale to be made October 6, unless objections were made. The ice machine company failed last October, and its affairs have since been in court. The proceeds of the sale will go to the creditors.

——The Alabama Ice and Cold Storage Co.'s plant at Birmingham, Ala., was sold September 1, to W. T. Wildrup for $10,000, at a special master's sale, to satisfy a decree in equity of the United States court in favor of the American Refrigerating and Construction Co., of Pittsburgh, for $16,350. It is understood that Mr. Wildrup made the purchase for the above firm.

——The Central Trust Co., of New York, September 4, made application for the appointment of a receiver for the Maryland Ice Co., of Baltimore. The ice company on March 1, 1891, issued bonds to bear 6 per cent interest, to secure which first and second mortgages were made to the Central Trust Co. The bill alleges default in payment of the interest, and that the ice company is insolvent. Counsel for the ice company has filed an answer consenting to the appointment of a receiver.



COLD STORAGE AND THE FARM, AGAIN.

In a former issue, ICE AND REFRIGERATION called attention in a manner to the benefits of cold storage warehouses to the farmer, and entered a mild plea for the encouragement of their erection in the lesser cities of the country, which serve as market towns, where the merchant buys of the farmer direct. It requires no great acumen to understand that if it be profitable at times for the farmer to hold his grain in store, it would be even more profitable for him to hold also such products as spoil more readily than grain, unless stored under proper conditions. This is eminently true of butter, eggs, vegetables, fruits, poultry, etc., most of which are originally marketed at times of most unfavorable conditions of price, which cold storage facilities would in large measure reverse.

In continuing the exposition of these benefits, we are assisted at this time by the recently published letter of Mr. Edwin Taylor, president of the Kaw Valley Potato Association. The Kaw valley, of which Wyandotte county, Kan., is the center, is a great potato country, and in order to handle the product to the best advantage, the growers have formed an association by which the crop of the valley is handled as a whole. Very naturally the storage houses at Kansas City, thinking of the advantage of storage of the crop until the time of highest prices, sought for the custom of the association; and a recent letter by the owner of such an institution to President Taylor elicited this reply, which presents a need by potato growers there, as it does to growers generally throughout the country. He says:

"I wish to impress upon you before it is too late that we need also a kind of storage that you are not yet prepared to furnish, viz., cold storage. The idea of putting potatoes in cold storage is, likely, new to you. Let me show you wherein we should use it if it did not come too high. You may have heard me speak of my 'second crop' potatoes, from time to time. They were raised from seed that had been kept in cold storage in Kansas City, Mo., till wanted for the second planting some time in July, after the first crop was dug.

"Year before last, I paid Mr. Jones, of the Kansas City Cold Storage Warehouse, corner of Fourth and Grand avenue, seventy-five cents a barrel for some 450 barrels of potatoes to be kept at about thirty-three deg. from March to July. There were two big car loads. Counting the freight and the carting across the city, both ways, three cents per cwt., each way, it made pretty expensive seed potatoes.

"I am now trying to make a cold storage of my own, with water right from a well running through pipes. But I can see already, that while I have saved the freight by having a plant of my own, it will cost me more than I could afford to pay for a lower temperature. Keeping seed potatoes through for a second crop, however, is a small affair by the side of keeping them till spring only for the general market.

"We make a 'specialty,' as it is called, of 'seed potatoes,' and, though we have all as good cellars as can be made without some artificial refrigeration, still we cannot keep those seed potatoes through till planting time without repeatedly shoveling them over, and even then having some of them sprout. And the presumption that potatoes kept in this latitude are sprouted as a matter of course, attaches to ours and hurts our sales. Wherever we go they want northern-grown potatoes for seed. How completely we could offset that with our 'cold storage seed potatoes.' And if not sold for seed those same potatoes could then be eaten with as good a relish as when in their prime. Now they go at about half price to the grocery trade, if not sold for seed. Our potatoes have got to go to town anyway, and why should they not await a purchaser under perfect conditions, such as are secured in a cold storage warehouse, instead of losing vigor for seed purposes and palatableness for table use, as our present method necessitates?

"Cold storage for apples is familiar to everybody. Are you aware of the extent to which apple culture is projected in this country? There are three orchards at this place, aggregating 340 acres. One of them (100 acres) is mine. It is just coming into bearing, as are the others. We have discussed ways and means for a cold storage plant on the ground for these apples."

AN ELECTRICAL thermometer for low temperatures has been devised by a Russian physicist, who utilizes the variation in the resistance of a platinum wire at different temperatures. The instrument is said to be very sensitive, but slightly inaccurate when used for widely different temperatures.

PRACTICAL COLD STORAGE.

THE CARE OF EGGS IN COLD STORAGE—HOW TO PACK EGGS TO SECURE THE BEST RESULTS—DOES ARTIFICIAL REFRIGERATION CREATE A DRY ATMOSPHERE?

By D. B. Beemer.



TO CONTINUE the subject treated of in the September number of Ice and Refrigeration: "The Holding of Eggs in Cold Storage"—I recur to the matter of the damaging effects upon the eggs of the gases liberated from the paper fillers after having become damp through the absorption of moisture in the room. The idea naturally occurs in this connection, that it would be desirable to do away with the use of these paper fillers in cold storage.

In carrying out this idea, substitutes have been employed with different degrees of success. The most successful method has been to pack in oats and barrels. The oats used should be old and *thoroughly dry*. Under such conditions, these comparative advantages are secured. The oats being so dried before use, become of a woody nature, so to speak, and absorb moisture very slowly under such circumstances; hence, when packed about the eggs in the barrel, and the barrel then headed up tightly, it takes a long time for moisture to drive through the staves of the barrel in the first place, and then through the dry oats. The eggs so packed are sealed up nearly air tight, like fruit in a car. If the oats be dry and sweet, the eggs retain their original freshness much longer than when exposed to the air.

The barrels used should in turn be thoroughly seasoned, since, otherwise, the damp staves the more readily conduct moisture to the oats within. Under such circumstances, the process of absorption of dampness necessarily becomes so slow that eggs will carry longer and be of better quality than those in paper fillers. Oats intended for this purpose should be stored in shallow bulk in well ventilated lofts, or rooms, and carried for many months before using; and they should be used *only once* for this purpose.

Wooden fillers have been manufactured and used to some extent in the cold storage of eggs, and turn out better eggs when the room is fairly dry than the paper fillers; yet one can well believe that where there is much moisture in a room it will sooner drive into the eggs in *wooden* fillers than into those packed in paper fillers; because the wooden fillers lack the sponge-like absorbing qualities of the paper fillers, which for a time divert the moisture from the eggs to themselves. Paper fillers should be spread out in the sun, or in some place having a strong draft of air, and be dried *till they rattle* before going into cold storage with eggs; then it will require a longer time, relatively, to become saturated with moisture to that degree that they cease to divert it from the eggs, and, on the contrary, impart it to them.

"Excelsior" should be used both at the bottoms and tops of cases. It affords a good, springy cushion for the eggs to rest upon, and is slow to take up moisture. *Straw*, on the contrary, should never be used for this purpose; it attracts dampness quickly, and then becomes musty and imparts the must to the eggs.

As to *cases*: Some prefer poplar or whitewood, claiming that *pine* imparts its odor to the room and the eggs. In a warm temperature, this would be true to a certain extent, but in a *cold* temperature the pine odor is not noticeable. If there is any advantage in favor of the hardwood cases, it would seem to lie in the fact that they are not so porous as the pine cases, and cannot absorb or retain as much moisture. But with either material the cases, like the fillers, should be thoroughly dried before going into cold storage.

Second-hand fillers or cases should not be used. If at any time they chanced to have had broken eggs in them, it only requires the absorption of a little moisture to liberate the foul smell which may lie dormant while the case and fillers are dry.

ICE V. MECHANICAL REFRIGERATION.

I should like now to raise the question of the comparative dryness as between rooms cooled by *ice* and by *artificial cold*. With the last I have had no practical experience, nor have I had the opportunity of examining the output of eggs from any of them; but I think I understand the principle upon which they are operated sufficiently to discuss the matter intelligently.

Now, these rooms are cooled by and through a system of metal pipes, disposed about the rooms in coils or other forms, through which the cold air is forced, or converged. We can understand that these pipes, *at first* are *frosty dry*, and cannot, therefore, impart dampness to the room; consequently the room itself must be dry, while this state of things continues. But the pipes, being intensely cold, act *for a time as condensers*, gathering the moisture in the room into frost and ice upon their surface. This condensing process goes on till a certain thickness of ice is formed upon the pipes, when their power to freeze the moisture out of the room seems to *cease*. This point is reached when the surface of the pipes fails to accumulate ice and frost in the condensing process. Their surface necessarily then becomes *wet* and dripping, and should impart moisture to the room, like the dripping ice in the other system. If I am wrong in my reasoning and deductions, I should like to have some expert representing artificial cold system, show me and others *wherein*, and in what way, rooms cooled artificially are made dryer than those cooled by natural ice.

Then, again, the condensing surface of these pipes is very small as compared with that furnished by tanks in rooms cooled by natural ice, particularly in rooms tanked as mine are. For instance, the tanks used in my system to cool a room 10×20×10 to the freezing point have a radiating surface of galvanized iron equal to 400 square feet, all of which becomes *condensing* surface when the tanks are charged with ice and salt. Yet this relatively *large* amount of condensing surface, my experience shows, is not to be depended upon to do the work because, as in the case of the pipes in the artificial cold system, ice formed on their surface by the condensation of moisture from the room finally becomes so thick that the power of the tank to force the cold through it with sufficient force to keep its surface in that dry and frosty state necessary to continued condensation *ceases*.

I am, of course, referring to a room held *above* freez-

ing point. In a room held constantly *below* freezing point all moisture is necessarily frozen out of the room by the normal temperature of it.

In short, I do not see why the same necessity does not exist for an automatic condensing apparatus to dry the rooms cooled by pipes and cold air that obtains in natural ice systems, and which drove me to invent, and successfully apply, the one I use in my system and plant. Before its application, I have seen ice form on tanks, in condensation, from four to six inches thick; now no ice forms upon them, because the condenser does the work forced upon them, leaving a clean metal surface to radiate the cold into the room. This economizes ice and gives more cold relatively, while giving dry air.

HOTEL REFRIGERATION.

The new H. C. Brown hotel, at Denver, Colo., to cost $2,000,000, in line with many others of the finest hotels in America, has made a contract with the Hercules Iron Works, for an ice making and refrigerating machine of twenty tons refrigerating capacity, which will be used for making pure crystal ice for the use of the hotel, and for furnishing cold storage. The specifications call for one of the finest ice plants ever erected for hotel purposes.

In fact, the American hotels have improved wonderfully of late years by adding luxury upon luxury to gratify the eye, to rest the body and to minister to the cravings of the appetite. Nay, more: a genteel boy in a dress suit day and night replaces the coatless young ruffian in a woolen shirt, and his successor, the superannuated waiter, in black alpaca roundabout. The ice and electric light plants, however, are *fin de siecle*, or, to use an equally comprehensive American expression, "way up in G." It has always been a difficult and troublesome thing to get large quantities of clear, pure ice for hotel purposes, and the speculative tendencies of the ice market of recent years have made it also expensive. Manufactured ice can be made pure, and in quantities to suit the current demand; and the cost of storage, waste and handling is reduced to a minimum. Ice frozen in *carafes* is also pleasing to the eye, and soothing to the æsthetic taste. Yes, when there is anything "fly" going on in the world, the American hotel man seems to be there—or thereabouts.

One doesn't usually think of it in "that way," but this item has a "suggestiveness" about it that is "interesting": "In July, 1881, the steamer City of Winnipeg, with several barrels of prime whisky in her hold, was sunk in Lake Superior, just opposite Duluth. Captain Lloyd is now raising the vessel, and he has invited a party of bosom friends to be on hand when she reaches the surface, in order to sample the whisky that has been in cold storage at the bottom of Lake Superior for ten years." It is not recorded whether Capt. Lloyd's guests, after tasting of the contents of this natural cooler, themselves kept out of the "cooler," but we assume, as a matter of course, that they did!

The *Bakers' Helper* may be classed with those wise men who know a good thing when they see it, for when it was stated that an Allegheny City company proposed to run pipes through the streets, with connecting coils in ice chests and refrigerators, ice cream freezers, etc., etc., and through them force brine at a north pole temperature, the *Helper* hastened to remark: "Now, what's the matter with that scheme? It is too late in the century to say pooh! pooh! With short circuits and proper pipes, why may we not be able to keep Alaska on tap in our stores and houses, just as they now do it in the great ice factories and breweries?" Verily, why not?

NEW COLD STORAGE PLANTS.

There is an apparent and gratifying growth of interest in the establishment of cold storage plants, particularly in the fruit regions. The enormous crop of this season has made, of course, low prices; and the thought is inevitable that the profits in fruit might be increased by cold storage facilities to give better control over shipments, which are now forced as the fruit ripens. The creameries, as well as produce shippers and dealers, are also getting their eyes open to its advantages; and it may not be an unsafe prediction to make, that in the North more particularly the cold storage plants are likely to increase in numbers more rapidly than the ice factories.

ARIZONA.

Phoenix—M. E. Hurley has just had built a large cold storage vault at the Central market, claimed to be the best in the territory.

ARKANSAS.

De Witt—The local paper is urging the erection of a cold storage house.

FLORIDA.

Key West—The South Florida Cattle Supply Co. is reported as erecting a cold storage plant.

ILLINOIS.

Chicago—The *Herald* says, September 14, that American capital will probably finish the cold storage building on West Lake street. J. E. Fuller, president of the company constructing the building, has returned from New York, and says that the option recently secured by Englishmen, to buy the plant at $4,500,000, will be allowed to lapse. The plant fronts on Lake and Randolph streets and the river.

IOWA.

Waterloo—S. Northey and others are talking of building refrigerators and cold storage plants, using the McCreary patents.

MARYLAND.

Baltimore—The Baltimore City Cold Storage and Warehousing Co. has purchased of the Johns Hopkins hospital fifty feet on South Eutaw and forty-six feet on West Conway streets, where a large cold storage warehouse will be erected.

MICHIGAN.

Allegan—A cold storage house is being talked of. It is said to be much needed.

Kalamazoo—Is talking of a cold storage house.

South Haven—A project is on foot to build a large cold storage warehouse for the fruit business on the lake shore.

MINNESOTA.

New Ulm—H. Crone, of the New Ulm Creamery Co., will this fall build a cold storage house for butter, eggs, etc., of fifteen to twenty tons capacity. He has not as yet decided on the system he will use, or whether he will cool with ice or by machinery.

MONTANA.

Great Falls—The Great Falls Meat Co. is making preparations to erect a cold storage house and freezer.

NEBRASKA.

Columbus—The cold storage building of Hagel & Co. is being pushed rapidly by the builders.

OHIO.

Toledo—Engelman & Stout are remodeling their building for cold storage.

PENNSYLVANIA.

Lebanon—The Union Brewing Co. are putting in a Frick machine.

WASHINGTON.

Fairhaven—Jos. Alsop's cold storage warehouse is now in working order.

WISCONSIN.

Appleton—Bailey & Rose have put in cold storage for keeping butter.



THE REFRIGERATOR CAR.

FURTHER STUDY OF ITS EVOLUTION—CURIOUS IDEAS OF INVENTORS—SOME DETAILS OF INSULATING CONSTRUCTION—A PORTABLE AIR COMPRESSION REFRIGERATING MACHINE.

A reader commenting on the article on "Refrigerator Cars," in the September number of ICE AND REFRIGERATION, says the writer mentioned cars he "never heard of," though he thought he had a pretty wide acquaintance with the refrigerator car in all its protean forms. It might be replied in the language of Hamlet, "There are more things in heaven and earth, Horatio," etc., for the files of the United States patent office disclose many remarkable conceits, the patenting of which seems to serve no definite purpose other than to provide "ways and means" for the patent attorneys. The inventor is not necessarily a "crank," but one who delves into the musty records of American inventive genius must confess that the thought often comes to him that many a "crank" is there embalmed in a sort of death-in-life immortality. Few of the thousands of "inventions" of all sorts have any real practical or commercial value; fewer still can really be said to be the exposition of new principles; but the succession of ideas, unique conceptions and valueless contrivances is endless. While it would not be kindly to hint that the inventor of even the most impracticable refrigerator car may be classed with the genius who would bore an artesian well by scratching a hole in the ground and sending down a few pounds of quicksilver to find water and leave a hole behind it for the water to come to the surface—a device honored with patent protection,—still it is not strange, in the light of the record, that there should be many cars of this type that well informed men should never have heard of, and perhaps are not worth hearing of, except as curios!

Continuing our delving into the records in search of the mechanical history of the refrigerator car, but without expressing any opinion as to the individual merits of the successive patents granted, which is hardly necessary in this sort of a review of the evolution of that species of public carriage, we reach the car patented December 28, 1875, by Mr. James Turner, of Chicago (171,491). It is of the usual form of freight car, with an extension at the center of the roof, in which from above is a man-hole. In this extension is the ice chamber, the ice resting on slats and a series of shelves on the sides of the chamber. These slats are of different widths, smaller at the top; and between and behind them are air spaces, while a partition separates the ice and its surrounding air spaces from the body of the car. This air chamber is carried over the provision chamber and down the side of the car, with openings into the body of the car at the top in the extension over the ice and at the bottom of the side cold air chamber, creating a circulation of air through the car. The drip is caught by a trough under the ice, and turned into coils of pipes located in the side cold air space, by which the cooling effect of the melted ice is utilized as much and as long as possible. Ice and salt are the preferred refrigerants; and a special claim is set up for this system of pipes to use the melted ice for cooling the car in addition to that obtained by the ice itself.

The specifications of the car of A. Thoma (Hoboken, N. J., 171,591, December 28, 1875), are quite elaborate, and include special claims for insulation. This car is built with its outside boards painted white, and the inner surface coated with a water and air tight varnish which is specially prepared for the purpose. Over this varnish is laid a sheet of paper also similarly varnished. Strips of wood hold this paper in place, and then boards of a very porous wood are laid on (obliquely to give firmness to the car), both sides of which are coated with a solution of soluble glass. The glass is a non-conductor of heat, and applied to the porous wood confines the air within the wood. The space created by the strips over the paper and under the porous boards is filled with pulverized vitreous slag, made in a pasty mass by mixing it with the solution of glass, which when hardened becomes a perfect non-conductor of heat. Well spent tan bark, cow's hair felt, or disintegrated moss, may be used instead of the mixture of slag and glass as a filling. The porous boards secured, more solution of glass is applied to them; then one inch of hair felt is used, and then more boards, coated inside and out as before. The ice chamber is at one end of the car, ice being taken in from the side of the car near the top. In the upper part of the ice chamber is a blower, operated by a power attachment to the axle of the car, which sucks the air up through the ice and forces it through a pipe placed under the roof in the center of and for nearly the full length of the provision chamber, this pipe having convenient openings in its length through which most of the cold air escapes into the car, the balance finding

exist at the farther end. The air re-enters the ice chamber below the ice, through openings provided with charcoal screens for filtering the air and keeping it pure. Provision is made also by vents for changing the air in the car and removing the gases proceeding from the meat in the car during its cooling, after which the vents are closed, the circulation thereafter being of cold air only. [*Query:* Does not the present system of chilling meat in the abattoir cooling rooms before loading remove the probability of gases forming in the car during shipment?] He would keep his car at a temperature of 44° to 46°, filling the ice chamber after the meat is loaded into the car: and after reaching a temperature of 44° or 46° the blower may be stopped unless the temperature (indicated by a thermometer visible from the outside of the car), should rise above 46°, when it may be again started up.

The car of Arnold W. Zimmerman, Denison, Tex., (172,546, January 18, 1876), provides an air space above the ice, with passages for the cool air to sink below into the provision chamber, and ventilators in the top of the car for the warm air to escape, on the theory that the cold air descending will force the warm air up the sides of the car and over the ice or out at the ventilators.

Josiah E. Winants, Wilmington, N. C. (173,198, February 8, 1876), makes a radical departure by putting an air compressor in his car. The compression pump is operated by a belt attached to the axle of the car, by means of which he would compress air to two atmospheres. A blower, similarly operated, forces the outside air over the surface of the compressed air receptacle to reduce its temperature, after which the air thus cooled is turned loose in the provision chamber of the car to reduce the temperature therein. About one-third of the car is occupied by his machinery and compressed air receptacle, which looks very much like a small upright tubular boiler.

The car of John M. Ayer, Chicago (181,391, August 22, 1876), is chiefly noticeable on account of his claim for insulating construction, the claim being for a roof of boards, with an air space between and over an India rubber sheathing, combined with an inside board lining to form an additional air space under the India rubber. The cold air from the ice is made to pass first through a special compartment, which by this arrangement is cooled to a lower temperature than the body of the car.

The record thus carries us down to 1877, when we begin "to see daylight," so to speak—when the cars now in most general use begin to appear in the line of succession. Some of these will form the subject of subsequent study.

A COMMON method of cooling wines in India before the introduction of ice and ice machines was one which seems almost a paradox: the bottle was wrapped in flannel wetted with water, and placed directly in the rays of the sun. Violent evaporation ensued, and the wine actually became cool. This is a hint to the picnic fiend who carries his beer in bottles, but forgets to carry ice along with the custard pie.

BOILED water, as Dr. Black, of Edinburgh, found many years ago, freezes more rapidly than unboiled. The act of boiling expels the air, and as in freezing a similar expulsion of air takes place, a step is gained in advance of unboiled water.

REFRIGERATION ON STEAMSHIPS.

Nearly all the steamers of modern construction contain refrigerating rooms to preserve the fresh meat and to avoid the shipping of live cattle, which are always an incumbrance, and require special care, says the *Journal de la Boucherie*. These compartments possess, besides this, the great advantage of facilitating the importation into Europe of frozen meats, especially from America and La Plata. After having attempted several different systems successively and abandoned them, the equipment companies have adopted a plan by which the meat which is to be preserved will be exposed to a continuous current of dry, cold air.

Referring to this, Captain Muller says in his journal, *Le Yacht*: "The meat which is constantly kept in dry, cold air will retain all the watery parts and the juice, and under these conditions it can be preserved for several months. The first refrigerating cold air machine was, as we believe, the one of P. Giffard. This machine has been used for a long time by *Societe Francaise du Froid*, which was established in Grenelle. The machines of Coleman, and other similar ones, are only Giffard machines which have been modified. Now, however, it is the machine of Hall which seems to unite the greatest advantages, and for this reason its use has become very general."

If to-day most of the first class steamers are provided with these cold air blowing machines for the preservation of fresh victuals, it is because this system is preferable to ice. In fact, the meat in contact with the melting ice becomes streaked and slimy, and the moisture with which it becomes strongly saturated offers a field of activity for detrimental and unhealthy germs. The machines of Hall produce the cold air by means of compression (contraction and expansion of ordinary atmospheric air), and this without having recourse to any chemical substance. Special precautions are being taken to guarantee the dryness of the cold air which is furnished by the machines in question, which is allowed to expand at extremely low temperatures. If one uses machines of great dimensions one can succeed in producing the cold air at a temperature of 73° C.

These machines made it possible for the steamer *Salembria* to import from the Falkland islands to Liverpool, a cargo of 30,000 carcasses of mutton, which was delivered in excellent condition in the month of August, 1886, which was the beginning of a trade in frozen meats from New Zealand, etc., which has since increased to enormous proportions. They have also been in use in the cold storage warehouses of the Victoria docks, London, since 1882. The two steamers of the company of the United Stevedores, *San Martin* and *Belgrano*, have each large compartments for the transportation of frozen meats from La Plata to Havre, and are provided with machines of this type. Three other steamers of the same company, the *Dom Pedro*, the *Pampa* and the *Parahyba*, have recently been provided each with a refrigerating compartment large enough to contain 10,000 carcasses of mutton. The appliances for the production of cold air, which are regular blowers, are based on the principle of retaining the cold air without variation of temperature.

VASELINE is said to be among the best materials for keeping bright iron from rusting.

PACKING FRUIT FOR TRANSPORTATION.

The instructions of the British Pomological Society respecting the packing of fruit for transportation advise that for protection against injury from pressure it be packed in boxes or stout baskets; against shaking by using cases of moderate dimensions, or cases cut up by partitions, and by laying the separate articles so closely and compactly that they shall just keep each other steady, without crushing. Packing material which might communicate an unpleasant flavor should not be used. The bloom of fruit is best preserved when they are packed in young nettle tops, partly dried, or in cartridge paper. Grapes carry best if tied down to the bottom of a shallow box, or when each bunch is inclosed separately in a piece of stout cartridge paper. Melons should be inclosed in cap paper, placed in a box, and surrounded by bran, chaff or dry sawdust. Peaches, nectarines and apricots should be carefully inclosed in a piece of tissue paper and kept separate from one another by cotton wool. Plums, when the bloom is important, should be rolled up, six or eight together, in a piece of cartridge paper, and tied around with matting. When the bloom is not important, they may be packed in strawberry or similar leaves. Cherries, gooseberries or currants travel very well, under general circumstances, if laid together in small, shallow baskets, or punnets. In packing strawberries, raspberries and mulberries, each fruit should be separately surrounded by one or two strawberry leaves.

THE TRANSPORTATION OF FRUIT.

The California Fruit Transportation Co. (C. F. T.) has become a very important factor in the shipment of green fruit from the Pacific coast. It began its operations in the summer of 1888, with a very limited number of cars, but the growth of its business has been so rapid that it now employs nearly 600 cars in this trade.

Previous to the operations of this company in the shipment of deciduous fruits from California, the universal method of transportation had been by ventilated cars, and it was thought that refrigeration would be a detriment to the fruit, and that the sudden change of temperature when taken out of the car would result in rapid decay. Thorough experimenting, however, by this company, covering a period of several years, on all classes of fruit, in all kinds of weather and varieties of climate, has resulted in the perfection of a car employed by this company, which meets more nearly the wants of the shippers than any other at the present time.

This car embodies largely patents that are owned and controlled by the Hutchins Refrigerator Car Co. Not only has it been demonstrated that tender fruits can be carried successfully in its refrigerator car, but also that it has been possible to ship them two or three times as far as heretofore, and to have them come out of the car fresh and sound, even in the hottest weather. It is proper to state that before the active operation of the C. F. T. Co. in shipping California fruits, Chicago was the eastern point for distribution, only a few stray cars going beyond. One object of this company has been the completion of a transportation service that will admit of a much wider distribution of the product, as the acreage having increased enormously in California, the market should increase proportionately. The result has been a very extended demand for California products all over the eastern states, New York taking from 600 to 1,000 car loads in the summer; and Boston, Philadelphia, Cleveland, Omaha, Lincoln, Kansas City, St. Paul, Minneapolis, Sioux City and other points taking this fruit by car load lots. While Chicago continues to receive and distribute the largest portion, it has been of inestimable service to the grower and shipper that the distribution has been so widely scattered by this company.

The company takes entire charge of the refrigeration of the product in transit, relieving the railroad from all responsibility on that score. It has its men and ice in the Sierra Nevada mountains, and has numerous ice houses for fitting its cars to receive fruit at various points in California.

The company has shipped since the first of June the present year, above 1,000 car loads of fruit. Its operations in the winter are confined to the Florida and southern trade, which, combined with California, gives it an entire year's business.

The rapid consumption of fruit by all classes of people in the United States has made the question of transportation and condition one of vital importance. It has been the aim of the California Fruit Transportation Co. to establish a service that would give fruit as nearly as possible a standard value, putting good fruit on the market at all seasons in good order, thus making it as nearly as possible a staple commodity, and within the means of all classes of buyers in all sections of the United States.

RAILWAY AND STEAMSHIP NOTES.

——The refrigerator cars used in shipping dressed beef cost from $750 to $950 each.

——The ice business at Florissant, Colo., is improving since the place became an icing station on the overland fruit route, seven cars of California fruits now being iced there daily.

——The Union Refrigerator Transit Co. is having a large number of refrigerator cars built by the Mount Vernon Car Co., which will be used largely in their Florida trade.

——The Chicago Cold Storage Transportation Co., at Chicago, has been incorporated to operate refrigerator cars; capital stock, $500,000; incorporators, William Brace, Louis Spahn and Alexander Peterson.

——The California Fruit Transportation Co. were among the pioneers in the carrying of fruit from California, and have been very successful. Their business has "kept up with the pace" of that growing trade at all times.

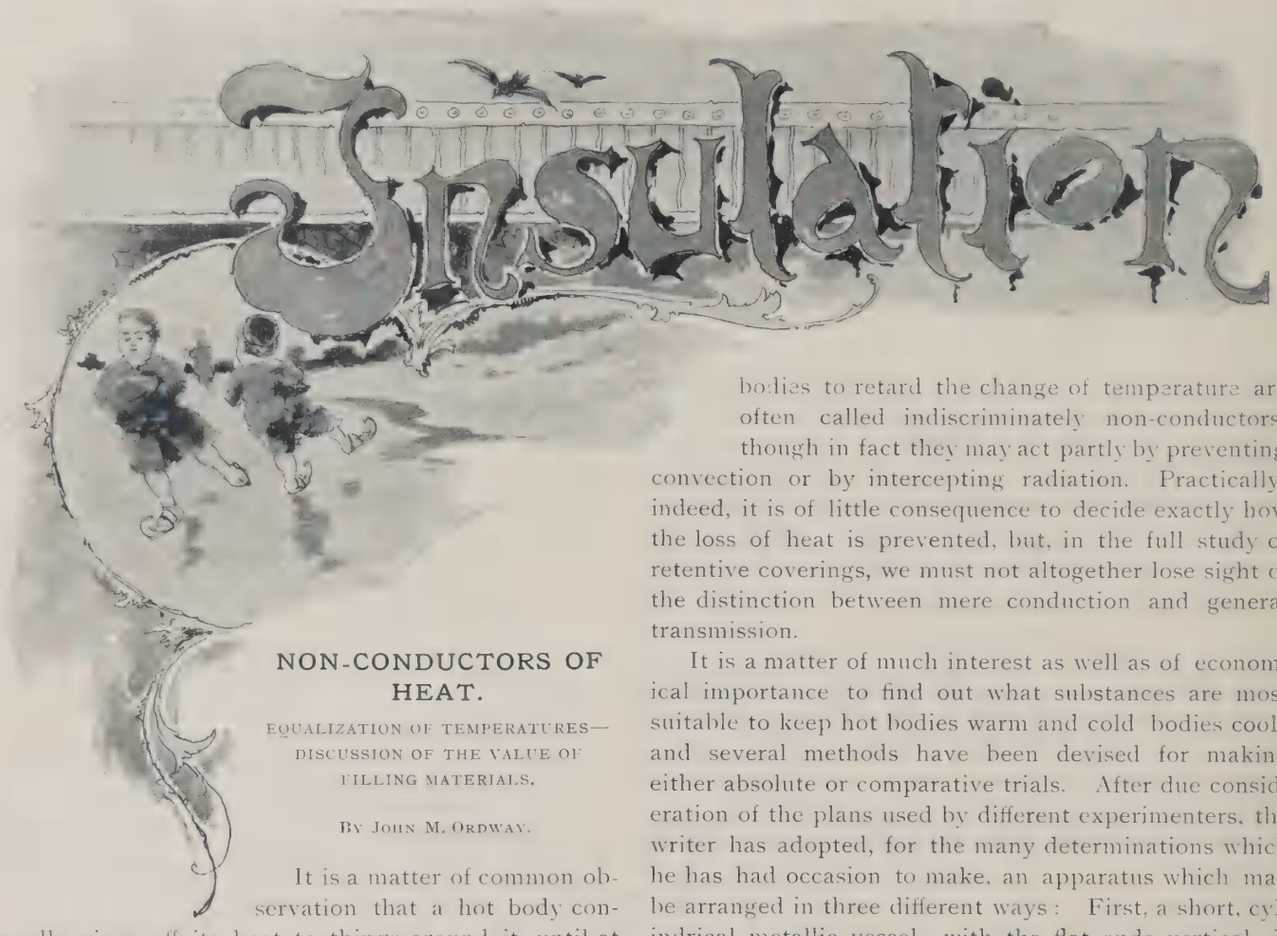
——The Duechting-McCray Refrigerator Car Co. has been licensed to organize at Chicago, to manufacture and buy and sell refrigerating apparatus for cars and to operate the same; capital stock, $50,000; incorporators, Anderson Fowler, Robert Clegg, William Duechting and others.

——The *British Trade Journal*, Sept. 1, notes the fact that refrigerator steamers are bringing to London River Plate, South America, sheep in large volume. There was in July a falling off in the importation of American dressed beef. The arrivals of frozen mutton were about 200,000 carcasses for July. Frozen lambs is another imported delicacy that markets freely.

——Since the practical exclusion of Canadian eggs from the states by the McKinley tariff, the Canadians have turned their attention to exporting to England; and the trade is increasing in volume almost every week. In ten days recently upwards of 3,000,000 eggs of fine quality were landed at Liverpool alone. They are said to weigh from fifteen to seventeen pounds per 120 (while the best continental eggs weigh from thirteen to fifteen pounds only), and are admittedly superior in quality to the choicest Irish eggs—a fact evidenced by their price, which has been from 4d. to 5d. per 100 more than is obtainable from the Irish product. The eggs are carefully packed and stored in the coolest part of the vessel.

——The Valdosta Ice Co., Valdosta, Fla., at last stockholders' meeting, elected J. R. Slater, president; W. E. Thomas, vice-president; B. W. Bently, secretary and general manager; E. W. Lane, treasurer.

——Robert J. Smith, past president No. 1, Cal. N. A. S. E., San Francisco, a delegate from the coast to the stationary engineers' convention at Omaha, made ICE AND REFRIGERATION a call, September 18. He will be glad to show engineers on the coast copies of this paper which he carried home with him.



NON-CONDUCTORS OF HEAT.

EQUALIZATION OF TEMPERATURES—DISCUSSION OF THE VALUE OF FILLING MATERIALS.

By John M. Ordway.

It is a matter of common observation that a hot body continually gives off its heat to things around it, until at length the giver and the receivers all come to a common temperature. This gradual equalization may be brought about in three different ways: In the first place, heat is thrown off in every possible direction from every point of a heated body by what we call radiation. Secondly, when air, water, or any other fluid is in contact with a hot surface that is not directly over it, the touching particles become warm and light, and move away to give place to others. This carrying away heat by the successive particles of a fluid is called convection. In the third place, when a solid substance is placed against anything of a higher temperature, its nearest parts are warmed and give up a portion of the heat received to those parts lying next to them: and these, again, share their gain with those next in order: and so on, till finally the outer surface heats whatever is in contact with it. Such conveyance of heat from particle to particle, without sensible motion, is termed conduction.

Strictly speaking, according to modern theory, radiant heat is a peculiar kind of undulation communicated to a supposed exceedingly subtile, all-pervading ether: and conduction is an oscillation of the molecules of the conductor itself. But, though we no longer consider heat to be a substance, it is convenient to use the old terms figuratively in describing the phenomena, just as we still say the sun rises and sets, though it is the earth that moves.

When we sit near an open fire, we are warmed by radiation through the intervening air, while the air itself is heated by contact with the fire, and passes up the chimney. So radiation and convection, or radiation and conduction, may go on at the same time, and when cooling takes place it is not always easy to tell how much of the effect is due to each of the causes respectively. Hence, substances that are put around hot bodies to retard the change of temperature are often called indiscriminately non-conductors, though in fact they may act partly by preventing convection or by intercepting radiation. Practically, indeed, it is of little consequence to decide exactly how the loss of heat is prevented, but, in the full study of retentive coverings, we must not altogether lose sight of the distinction between mere conduction and general transmission.

It is a matter of much interest as well as of economical importance to find out what substances are most suitable to keep hot bodies warm and cold bodies cool; and several methods have been devised for making either absolute or comparative trials. After due consideration of the plans used by different experimenters, the writer has adopted, for the many determinations which he has had occasion to make, an apparatus which may be arranged in three different ways: First, a short, cylindrical metallic vessel, with the flat ends vertical, is kept at a constant high temperature by a continual current of steam or hot water passing in at the bottom and out at the top. The non-conductor, of a regular thickness, say one inch, is applied to one of the flat faces of the heater. The other surface of the covering is in contact with a thin brass box, or calorimeter, filled with a known quantity of water to receive the transmitted heat. The number of degrees which the water is raised in an hour gives a definite measure of the amount of heat that the covering allows to pass through.

Secondly, in trying liquids or air for their conducting power, it is desirable to get rid of convection by heating from above, so that the hottest part of the fluid shall be and remain at top. Therefore the heater is suspended with its used face downward and exactly horizontal. The calorimeter, with its face also horizontal, is placed at any chosen distance below the heater, and is furnished with a curb of well varnished pasteboard extending up a little higher than the face of the heater. This curb is of a somewhat larger diameter than the hot box, so that there is a free space all around, and very little heat can be conducted by it.

Thirdly, in making practical tests of coverings for steam pipes, the non-conductor is put entirely around the pipe, and the calorimeter is made in two parts, with concave sides to fit the covering. Of course, in all cases the whole apparatus is surrounded by cotton wool or woolen blankets to prevent the disturbing influence of the surrounding air.

With the first arrangement, if the space between the calorimeter and the heater is filled with air only, which is confined by a curb of paper, but is free to circulate within the inclosure, the heat passes over rapidly, especially when the heater is at a very high temperature,

while in the second apparatus the transmission is slow. In the former case convection has full scope; in the latter, the air is stagnant and the heat passes downward by conduction and radiation. Therefore, still air has very little transmitting power, and confined air, which is free to move around within the inclosure, conveys heat readily.

Yet it is a not uncommon belief that, as air is a poor conductor of heat, a mere inclosed air space around a hot or a very cold body suffices to prevent change of temperature. It is said by some that an ice pitcher or a refrigerator needs only a double wall and no filling between. And we occasionally meet with loose statements like the following: "Confined air has long been regarded by scientific and practical men as one of the best non-conductors of heat." But it should be remembered that imprisonment is not always close confinement. The air must be fettered so that it cannot stir.

Now, if we fill the space in either the first or the second apparatus with cotton or fine wool, we shall find the transmission even less than with still air. And yet the fibrous matter may actually occupy only a hundredth part of the space which it apparently fills, and the fibers can touch the heated surface and each other only in a few points. Therefore the specific conducting power of wool or cotton can have very little to do with their capability of keeping back heat. We know not precisely what the conducting power of the solid matter of cotton may be, for we cannot compress the fibers far enough to destroy their elasticity and expel all the included air. But the woods are very similar in substance, and some of them are two-thirds as dense as fully compacted cotton would be. One of the dry, hard woods, heavy enough to sink in water, was found to have about four times the transmitting power of loose cotton. Were the transmission due to the substance of the fibers themselves, it would be increased by packing more in the same space. But, in fact, it is found that it is somewhat diminished by moderate crowding.

It would appear, then, that the efficiency of light non-conductors must be owing mostly to the imprisoned air which really occupies all but a small fraction of the space; and the stiller the air is held the better is the effect.

Of course the amount of friction which fibers can oppose to the motion of the entrapped fluid depends on their minute structure and arrangement. Thus in cotton they are long, flat, twisted, irregular in breadth, and variously bent. And as to fineness, it was found by counting and weighing some Sea Island cotton fibers averaging about an inch and a half in length, that it would take 17,000 to weigh a grain. Wool is scaly and very crinkly. Down is made up of flat threads with innumerable short, loose branches. The heads of the common cat-tail (*Typha latifolia*), which make a good non-conductor, consist of brown seeds, each having a stalk with very spreading branches. The seeds, with their appendages, are so very fine that 800 of them weigh only one grain. They may well float, as each one, for its weight, presents a very extensive surface to the air; and for the same reason, in mass they serve to keep the air stagnant.

Ground cork and some other barks, and the sawdust of the soft woods, as well as the charcoal made of these substances, are very good retainers of heat. Lampblack also works well. When the thing to be kept hot is at a very high temperature, some light, incombustible powders are very suitable. Among the best of these are fossil meal and the calcined magnesia and magnesium carbonate of the druggists. Fossil meal consists of the silicious skeletons of microscopic vegetables, called diatoms, exceedingly various in shape and size, the very largest of them hardly reaching the length of a hundredth of an inch. It is found abundantly in some peat meadows and in the bottom of ponds. Both fossil meal and magnesium carbonate have been largely used in covering steam pipes.

Obviously, when the same light substance is tried in both the first and second apparatus above mentioned, and the results differ, it must be owing to the inability of the substance to hold the included air still in the first arrangement. So powdered plumbago, or black lead, which is very slippery, shows nearly twice as much transmissive power in one case as in the other. Loosened asbestos fiber also lets through about twice as much heat in the vertical arrangement as in the horizontal. Yet this fiber may be split up exceedingly fine: but the great difference in its behavior as compared with cotton or wool must be owing much less to its own greater specific conducting power than to the smoothness and inelasticity of its fibers. It has too slight a hold on the included air. The more finely shredded it is the better it works: but our experiments have proved that it is not to be recommended as a non-conductor. And yet asbestos is often spoken of as though its excellence in this respect were unquestionable: but because this wonderful mineral is very useful in many ways by reason of its incombustibility, it does not follow that it has any magic virtue in its other relations to heat. Asbestos paper intercepts heat somewhat better than the loose fiber; but a great many layers must be put together, and then the virtue is by no means commensurate with the cost. It is sometimes recommended as a suitable article to put between floors to prevent the spreading of a possible fire; but those who propose it for this use seem to overlook the fact that the efficiency of non-conductors is nearly proportional to their thickness, and, though an inch might be of some service, one-fiftieth of an inch can do very little good.

Fibrous matters and powders in the loose state are somewhat troublesome to confine in the form of coverings, and hence they are sometimes consolidated into sheets or blocks which can be handled without breaking, and applied easily. Hair-felt, which is made in thick sheets from the hair which tanners scrape from hides, is cheap and is very serviceable when the heat is not scorching. Paper pulp has been formed into very thick, hollow, half-cylinders to put around steam pipes. Carbonate of magnesium and fossil meal cohere when moistened and slightly compressed, and they may be made into slabs with the addition of a very small percentage of hair or asbestos to give toughness. Such a paste may be plastered directly on steam pipes or boilers, and allowed to dry, the fiber serving to prevent cracking: but the greater compactness of light materials so consolidated renders them less effective, especially when a heavy cementing substance is added, like clay or plaster of Paris.

Of non-conducting substances that are already in the solid form, the light woods are often used advantageously. It should be noticed that most of them conduct

heat much better along the grain than across it. Thus a cross-section of *Liriodendron*, or yellow poplar, was found to transmit heat nearly twice as fast as a board of the same thickness sawed lengthwise. Cork is expensive and hard to get in large pieces; but it is far preferable to wood, as it is lighter and more elastic, and does not absorb water. Very porous and light bricks confine heat much better than those that are hard burned, but they must be kept dry.

The presence of moisture in a non-conductor greatly impairs its usefulness, as every one knows who has attempted to hold a hot body with a damp cloth. Count Rumford, who long ago did much valuable work in the experimental study of heat, concluded that fluids have no conducting power at all, but transmit heat solely by convection, and, accordingly, water is still sometimes spoken of as an exceedingly poor conductor. But later investigators have disproved the correctness of that idea. Our own trials show that, when convection is obviated, water transmits in a given time six times as much heat as hair-felt of the same thickness, and nearly eight times as much as still air. Others have found that bisulphide of carbon and ether transmit heat even better than water; but most liquid substances are slower conductors. Thus it takes more than twice as long for a given amount of heat to pass through cotton-seed oil or lard oil as through water.

As to the gases, some physicists seem to have proved that heat passes through air more readily than through a vacuum, while hydrogen has six times as much transmissive power, and carbonic acid half as much as air; but none of them used apparatus that would give absolutely certain results.

To show more clearly the retentive power of various substances, we subjoin the following table, in which the first column of figures shows the net percentage of solid matter in a given space. The second column of figures gives the number of English units of heat transmitted in one hour through one square foot of the covering one inch thick, the average difference of temperature between the heater and the water in the calorimeter being 100° F. By the English unit of heat is meant as much heat as will raise the temperature of one pound of water 1° F. Of course, the smaller the number in the last column the better is the substance for keeping a body warm or cold.

In some of the experiments the source of heat was steam at 310° F. In the others, a stream of water at about 176° F. was kept running through the heater.

It is plain that in choosing non-conductors for practical service we should take into account something more than their heat retaining power. They should be of materials that are abundant and cheap; clean and inodorous; light and easy of application; not liable to become compacted by jarring, or to change by long keeping; not attractive to insects or mice; not likely to scorch, char or ignite at the long continued highest temperature to which they may be exposed; not liable to spontaneous combustion when partly soaked with oil; not prone to attract moisture from the air; and not capable of exerting any chemical action on surfaces with which they are placed in contact. There is no one thing which combines all the desirable good qualities, but there is a considerable range of substances which fulfill most of the requirements. For steam pipes there have been many more or less suitable coverings in the market. But one should receive with much allowance the representations of dealers who sometimes continue to advertise what has been proved to be of inferior value. Not uncommonly they are anxious to sell that on which they can make the most profit, rather than that which is most efficient.

NON-CONDUCTORS ONE INCH THICK.	Net cubic in. of solid matter in 100.	Heat units transmit'd per sq.ft. per hour.
Still air		43
Confined air		108
" " =310		203
Wool = 310	4.3	36
Absorbent cotton	2.8	36
Raw cotton	2	44
" "	1	48
Live geese feathers = 310	5	41
" " " "	2	50
Cat-tail seeds and hairs	2.1	50
Scoured hair, not felted	9.6	52
Hair felt	8.5	56
Lampblack = 310	5 6	41
Cork, ground		45
Cork, solid		49
Cork charcoal = 310	5.3	50
White pine charcoal = 310	11.9	58
Rice chaff	14.6	78
Cypress (*Taxodium*) shavings	7	60
" " sawdust	20.1	84
" " board	31.3	83
" " cross-section	31.8	145
Yellow poplar (*Liriodendron*) sawdust	16.2	75
" " " board	36.4	76
" " " cross-section	30.4	141
"Tunera" wood, board	79.4	156
Slag wool, best	5.7	50
Carbonate of magnesium	6	50
Calcined magnesia = 310	2.3	52
"Magnesia covering," light	8.5	58
" " heavy	13.6	78
Fossil meal = 310	6	60
Zinc white = 310	8.8	72
Ground chalk = 310	25.3	80
Asbestos in still air	3	56
" " movable air	3.6	99
" " " " = 310	8.1	210
Dry plaster of Paris = 310	36.8	131
Plumbago in still air	30.6	134
" " movable air = 310	26.1	296
Coarse sand = 310	52.9	264
Water, still		335
Starch jelly, very firm, "		345
Gum-Arabic mucilage, "		290
Solution sugar, 70 per cent, "		251
Glycerin, "		197
Castor oil, "		136
Cotton-seed oil, "		129
Lard oil, "		125
Aniline, "		122
Mineral sperm oil, "		115
Oil of turpentine, "		95

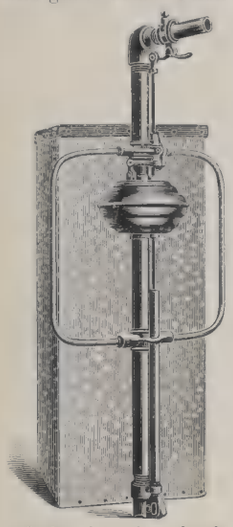
—*Popular Science Monthly.*

A CHICAGO architect announces the invention of a new fireproofing material which is also an "absolute non-conductor of heat," as well as light in weight and capable of being cut like pine. This material, called a "silicated fiber," is delivered in sacks, and is fixed by suspending upon the beams wire netting of a gauge which will furnish the strength required for the floor. Upon and through this wire mesh is dumped, in the simplest manner possible, the fireproof material, which is of the consistency of paste, on a molding board at the ceiling line up to the required floor level, when it is allowed to harden. This process requires about an hour. It is said to have a high resisting power against weight.

DURING the year ending September 1, New Orleans produced $395,000 worth of ice.

ICE CAN FILLER.

The Sauls patent ice can filler, herewith illustrated, is fastened to the filling hose in the same way as the common filler, and when put into the can is held in place and upright by the guide rods. Then the hand lever shown on nozzle is pressed, and this movement opens the water valve at lower end of main pipe; then the weight of the float springs a catch over a collar that is fastened to the tripping rod that leads from the hand lever to a lever that operates the valve in bottom; and when the water comes up to the right height the float springs the catch and allows the valve to be shut by a strong brass spring that holds it down on its seat, thus cutting off the supply of water until it is desired to fill another can, when the same operation is repeated.



The advantage of its use is that when the tank man steps out "for a minute" and neglects his can, the filler, acting automatically, fills the can to the proper height, and then stops the flow of water. There is no overflow, no waste of distilled water to be bailed out of the can and out of the freezing bath nor unnecessary use of salt to convert distilled water run into the tank into brine. Sauls Bros., Columbus, Ga., will send circulars on application. The filler is highly commended by those who have used it.

ICY ITEMS.

——The Consumers Ice Co., at East Los Angeles, will remove their works to San Berdoon.

——Joseph Howard, of Brooklyn, has purchased the ice factory of James Watt, of Thomasville, Ga.

——Lovell Bros., of Eustis, Fla., will remove their ice factory to Tavares, Fla., to get better transportation facilities.

——The ice company at Ventura, Cal., has been shut down for repairs, about a mile of new pipe replacing the old coils.

——The Southern Ice Machine Co., of Chattanooga, Tenn., has received orders from South America for three 50-ton ice machines.

——L. H. Mace & Co., of New York, will rebuild their refrigerator factory recently burned. They will expend $60,000 on buildings.

——A committee of the Kansas City council went to St. Louis recently to examine the pipe line refrigerating plant in operation there.

——The Alaska Refrigerator Co. have registered at Washington the trade marks "Sitka" and "Greenland" applied to their refrigerators.

——Benj. Wiltse, an old citizen of Catskill, N. Y., died September 4, aged eighty-five years. He was a pioneer manufacturer of ice elevating machinery.

——Having had an accident, necessitating repairs, the ice factory at Victoria, Tex., has shut down for the season, and a new plant will be put in for next season.

——A. W. Hope and Mrs. H. E. Miller have sold their interest in the Alton, Ill., Coal and Ice Co. to G. W. Paisley, of Hillsboro, and J. R. Paisley, of Litchfield, Ill.

——The Gurney Refrigerator Co., of Fond du Lac, Wis., has been reorganized, and the capital stock increased to $40,000; C. J. Medberry, president; C. R. Harrison, secretary and treasurer.

——The will of the late David Boyle was admitted to probate at Chicago, September 28. The property, valued at $75,000, is left to the widow, confidence being expressed that she will provide for the three children.

——Capt. Charles Fulton has resigned his position with Wetmore & Gladwin, of the Indian River Ice Manufacturing Co., Titusville, Fla. He is succeeded by Mr. Cuthbert, formerly boating on the St. Johns river.

——The Alaska Refrigerator Co. are removing their works from Michigan City, Ind., to Muskegon, Mich., and expect to be settled in the latter city by October 1. The new buildings and yards will cover seventeen acres.

——The dealers in natural ice and artificial ice at Tacoma, Wash., have started the old chestnut discussion of the relative purity of the two kinds of ice, in the newspapers, with the usual results—bad feeling on both sides, which does no possible good to the business in that city.

——The annual election for officers of the Plaquemine Ice and Cold Storage Co., Limited, was held September 8, with the following result: S. Piriart, president; J. McWilliams, vice-president, and C. N. Roth, secretary and treasurer, and they, with Messrs. Austin, Hunt, Bertrand, Beyris, Charles J. Ruff and Henry Wilbert compose the board of directors.

——The Consolidated Refrigerating Co. is about to be reorganized, notice thereof having been sent to the stock and bond holders by the committee on reorganization (Chas. J. Canda and Geo. M. Hard, of New York, and Robt. D. Thornburgh, of St. Louis), who have received from quite a number of creditors notice of their willingness to settle their claims under the proposed reorganization scheme.

——The Denver United Brewers, as the English syndicate in Denver is called, have entered into an agreement with the Colorado Ice and Storage Co. not to manufacture or sell ice in Arapahoe or Jefferson counties, Colorado, for ten years. In consideration of this the ice company agrees to deliver to each of the breweries, during the ice cutting season, 1,000 tons of ice, and not exceeding 4,000 a year beyond the amount of 1,000 tons, at a price not to exceed $1.50 a ton.

——The United States circuit court for the northern district of Illinois held, in the recent case of the Alaska Refrigeratar Co. *v.* the Wisconsin Refrigerator Co. *et al.*, that in order to defeat a patent for a combination it is not enough to show that all the elements of the combination, separately considered, were old at the date of the invention; that a reissue cannot be held invalid because of enlargement of claims when the original patent is not in the case, and no evidence is offered to show expansion in the reissue beyond what is justified by the original specification and drawings; and that the presumption is in favor of the validity of a reissue applied for and obtained in less than two years after issue of the original patent. On August 17, Judge Blodgett entered a final decree in the case, enjoining the Wisconsin Refrigerator Co., from infringing on the Alaska Co.'s patents. It was charged by the complainants that defendents infringed on a patent for a false bottom in refrigerators which gave a more perfect circulation of cold air. An appeal by defendants was taken.

THE FIRE RECORD.

——L. C. Green's ice house, Sidell, Ill., has been burned.

——George Wesit's ice houses at Eldon, Iowa, were burned September 16.

——The ice house of M. A. Searles, Oshkosh, Wis., burned September 17; loss, $2,500.

——The Treleven ice houses, Fond du Lac, Wis., were burned September 11; loss, $2,500.

——J. R. Morin & Co.'s creamery at Van Horn, Iowa, was burned September 1; some machinery was saved.

——Hart & Sheehan's ice houses at Troy, N. Y., were partially burned September 13; cause, supposed incendiary.

——The ice house of the C. & A. railroad, at Bloomington, Ill., was partially destroyed by fire September 10; insured; cause, locomotive sparks.

——The Reed & Powell Transportation Co.'s ice and storehouses, at Coxsackie, N. Y., were burned September 6; loss, $12,000; insurance, $10,000.

——The U. P. R. R. ice houses, at Armstrong (Armourdale), near Kansas City, were damaged by fire September 14; loss, $5,000; insured; cause, locomotive sparks.

——Three ice houses owned by Sheehan & Hart, Cohoes, N. Y., were burned September 9; loss, $2,000; partly insured; cause, supposed incendiary. Of ice 3,000 tons were lost.

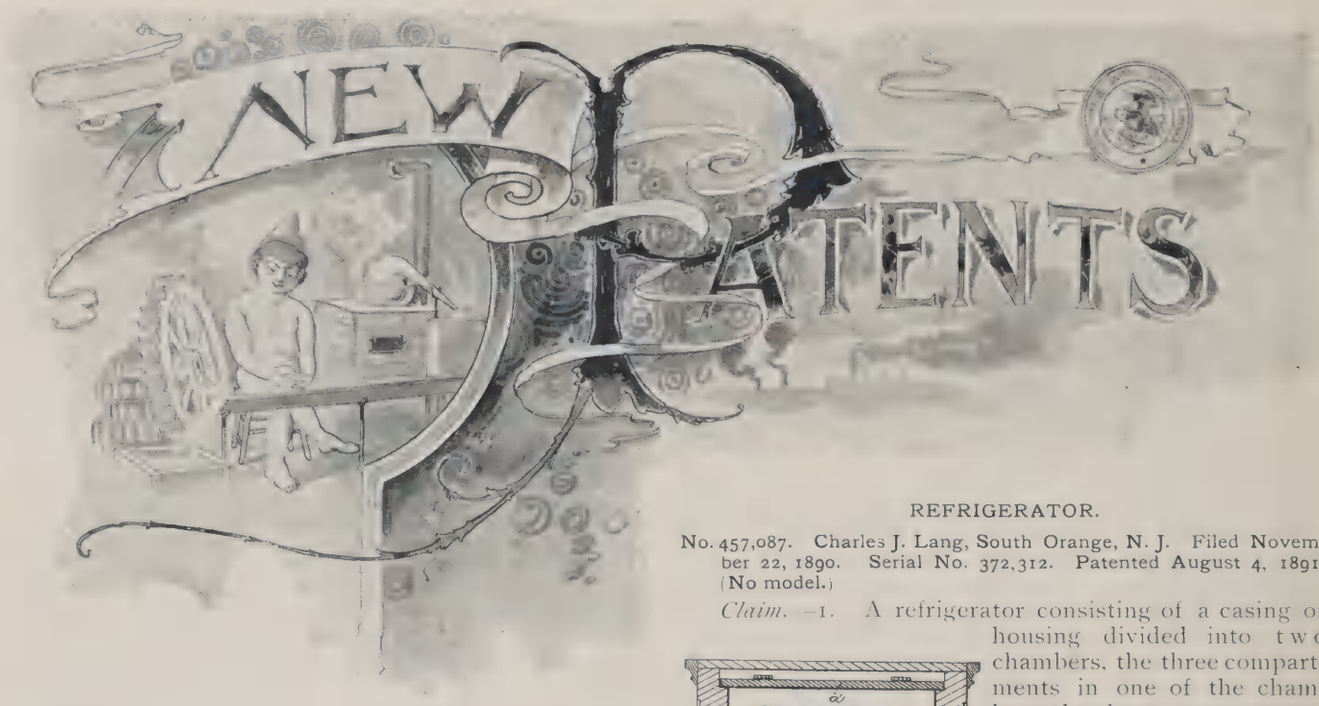
——Two large ice houses belonging to Chas. Pullen, at Atchison, Kan., were burned September 3; loss, $3,500; partially insured; accidentally fired by boys playing with matches.

——The Raleigh (N. C.) Plate Ice Co.'s plant was partially destroyed by fire August 29, the freezing room and ice house being burned, leaving the tanks uninjured; loss, $10,000; fully insured. The factory will be rebuilt.

——The ice houses at Holyoke, Mass., owned by the Holyoke and South Hadley Falls Ice Co., together with a barn and two houses, were burned September 2. A child in one of the buildings was nearly suffocated, and may die. The loss on buildings was $10,000, and the fire is believed to have been the work of incendiaries.

——The nine ice houses of the Indianapolis, Ind., Ice Co., owned by Armstrong & Co., burned September 14. Two were filled with ice, about 150 tons in all. The loss will reach $25,000; insurance, $10,000. The fire was started by John Zerbart, aged nine, who says a big boy coaxed him to light some loose hay with a match given him, and when he tried to put out the flame the big boy would not let him.

——Martin Hendricks' cold storage house at Sturgeon Bay, Wis., with its contents, was destroyed by fire August 16; loss, $11,000; insured for $7,000. About 16,000 pounds of butter were kept in the refrigerator for the fall trade, but most of it was destroyed. There seems to be no exact knowledge as to the origin of the fire. The firm will rebuild as soon as possible. An ice house belonging to Leatham & Smith was also burned: loss, $1,000.

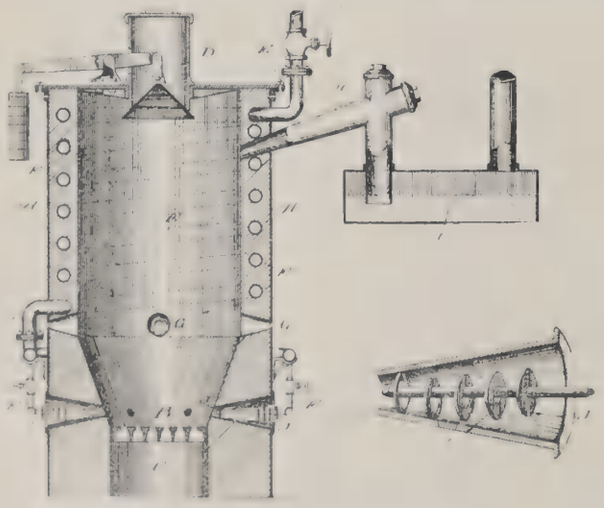


We append below the most important new patents, relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

PROCESS OF MAKING AMMONIA.

No. 459,193. Alphonse Hennin, Springfield, Ill., assignee, by direct and mesne assignments, to the Hennin Process Co., of Illinois. Filed December 24 1889. Serial No. 334,842. Patented September 8, 1891. (No model.)

Claim.—The process of simultaneously and continuously making gas and ammonia, which consists of injecting air or oxygen and steam into a bed of incandescent fuel, controlling the temperature of the generator, first by introducing such proportions of steam and oxygen or air as to maintain a zone of combustion at a temperature

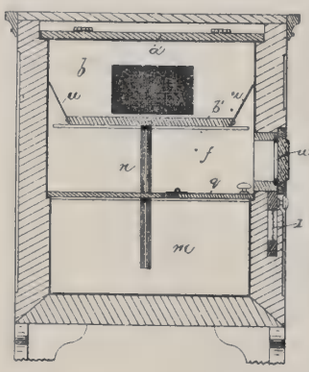


sufficient to reduce to carbonic oxide (CO) practically all the carbonous oxide (CO_2) formed by the complete combustion of the fuel, and to decompose practically all the steam so introduced in the blast, and second, by regulating the supply of fresh fuel to maintain beyond the zone of combustion a zone of distillation cool enough not only to allow the formation of ammonia, but to prevent the disassociation of that already formed, leading off the ammonia and gas and separating them by condensers, washers or other suitable means, substantially as described.

REFRIGERATOR.

No. 457,087. Charles J. Lang, South Orange, N. J. Filed November 22, 1890. Serial No. 372,312. Patented August 4, 1891. (No model.)

Claim.—1. A refrigerator consisting of a casing or housing divided into two chambers, the three compartments in one of the chambers, the three compartments in the other chamber, the upper forming the ice chamber, the doors for this compartment, the door for closing the opening between the ice chamber and upper compartment, and the screen in said opening, substantially as described.

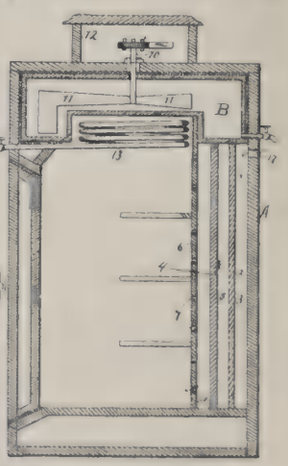


2. A refrigerator consisting of a divided casing, openings communicating with said casing from the side and ends, doors for closing said openings, the ice chamber having the bottom provided at the ends with the perforated plates, the compartments below the ice chamber, the conduit leading from the ice chamber to the lower compartment, the compartment at one side of the ice chamber communicating with the ice chamber, the screen between the chamber and compartment, and the compartments below said last-named compartment, all substantially as shown and described.

CHEMICAL REFRIGERATOR.

No. 458,726. Ralph Hirsh, Syracuse, N. Y. Filed May 9, 1890. Serial No. 351,204. Patented September 1, 1891. (No model.)

Claim.—1. The combination, with the box, of a chemical receptacle in its upper portion, an extension of the top of the provision chamber into said receptacle, a water coil in said extension, means for the circulation of water through the coil, and agitators arranged to operate in a path around the extension in which the water coil is placed, substantially as and for the purposes described.



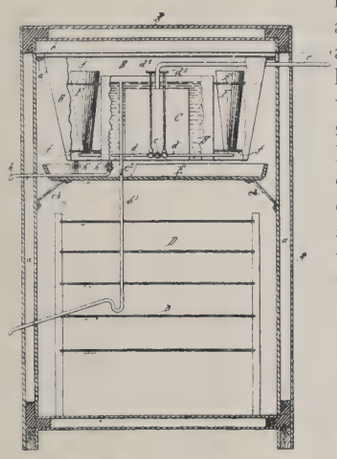
2. In a refrigerator, the combination, with the box, of partitions extending from opposite sides thereof, a provision chamber forward of said partitions forming side flues, with which the flues formed by the partitions at the rear of the provision chamber communicate, a supplemental bottom or floor for supporting the provision chamber and partitions, and suitable openings connecting the provision chamber with the flues at the

sides of the provision chamber, substantially as and for the purposes described.

ICE MAKING AND REFRIGERATING MACHINE.

No. 458,440. William H. Appleton, New York, N. Y. Filed January 29, 1891. Serial No. 379,547. Patented August 25, 1891. (No model.)

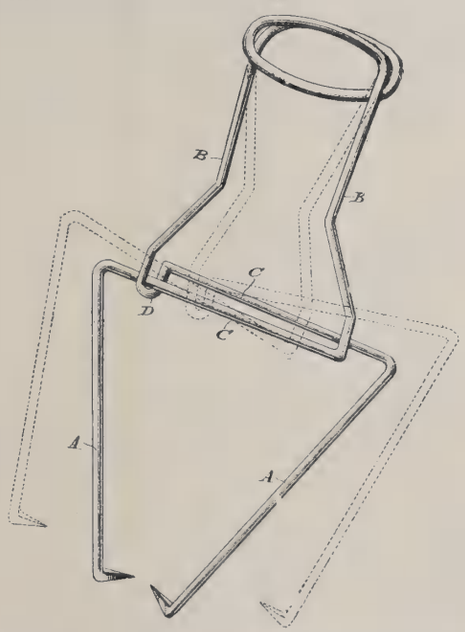
Claim.—1. The combination with an outer freezing-mixture-holding vessel of an ice making machine and a second freezing-mixture-holding vessel arranged within the same and constructed with its walls of less height than the walls of the outer vessel, of a receptacle or cooler for water arranged within the inner vessel, and connections whereby water delivered to such receptacle or cooler may be discharged into either one or both of said vessels, substantially as set forth.



ICE TONGS.

No. 458,383. Francis X. Brenner, Philadelphia, Pa. Filed February 25, 1891. Serial No. 382,782. Patented August 25, 1891. (No model.)

Claim.—1. Ice tongs consisting of spring jaws, handles and intermediate cross-bars, one of the latter having

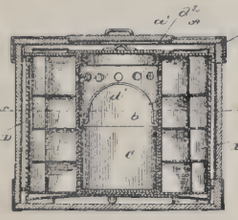


an eye or loop integral with said cross-bar and freely embracing the other bar, substantially as described.

REFRIGERATOR.

No. 458,153. Truman S. Caldwell, Highmore, Colo. Filed October 18, 1890. Serial No. 368,612. Patented August 25, 1891. (No model.)

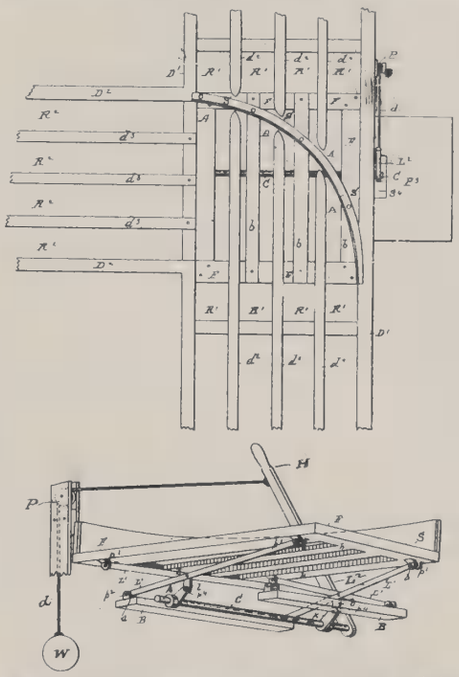
Claim.—A portable refrigerator having the outer casing *A*, provided with a door a^2, having suitable fastenings, and a removable top *a*, provided with a central perforation normally covered by a lid a^1, in combination with the tubular bottomless frame *b*, having a series of perforations near the top, an ice bucket *c*, adapted to fit in said frame, and the concentric carrier frame *B*, revolving axially around the frame *b* by frictional contact solely, and having equal concentric radial compartments for the storage of articles, the whole co-operating, as and for the purpose set forth.



SWITCH FOR ICE SHUTES.

No. 459,478. Edgar Littlefield, West Troy, N. Y. Filed April 16, 1890. Serial No. 348,168. Patented Sept. 15, 1891. (No model.)

Claim.—1. The combination, with an ice chute or run constructed with a curved slot in its bottom, and

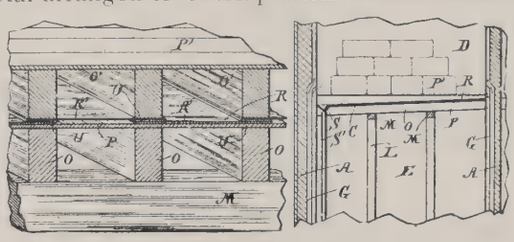


having a branch chute or run connecting with the side thereof, substantially as described, of a curved switch board adapted to rise or descend in said curved slot, substantially in the manner described.

REFRIGERATOR.

No. 459,037. Avelyn I. Dexter, Whitewater, Wis. Filed May 1, 1891. Serial No. 391,242. Patented September 8, 1891. (No model.)

Claim.—1. In a refrigerator or similar building, a metal floor or lining formed of independent plates or sheets of metal arranged to overlap each other at their edges,

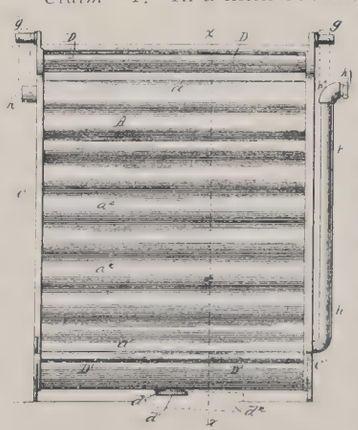


and an interposed felt or similar packing, whereby the expansion and contraction of the metal and a water tight joint are provided for, substantially as described.

MILK COOLER.

No. 457,533. Samuel M. Heulings, Jr., and Ellwood Evans, Haddonfield, N. J. Filed September 11, 1890. Serial No. 364,699. Patented August 11, 1891. (No model.)

Claim—1. In a milk cooler, the standards having on their inner surfaces curved ribs for supporting and determining the contour of the rounded ends of the cooling surfaces or plates, in combination with the corrugated plates *AA'*, having rounded ends, substantially as described.



2. In a milk cooler, the standards having on their inner surfaces curved ribs terminating in a bend for supporting and determining the form of the end corrugations of the cooling plates, in combination with the corrugated plates *A A'*, fitted to said ribs, substantially as described.

The Cool Hotel Piazza.



MR. WETHERBEE (*to hotel clerk*).—Mr. Smiler, there 's something wrong with the sun or this thermometer. Yesterday it showed fifteen degrees cooler than outside—to-day it's five degrees warmer.

MR. SMILER (*5:15 A. M. next day, to hotel porter*).—Pat, if you forget to put the ice in this column another time, as you did yesterday, you'll be bounced higher than that mercury went.—*Puck*.

AT Reading, Pa., the unusual weather of September has created a shortage of ice, all the dealers having exhausted their supplies.

WANTED AND FOR SALE ADVERTISEMENTS.

[The charge for advertisements in this column is $2 each insertion for seventy words or less, and twenty-five cents for each additional fourteen words. No advertisements will be inserted unless accompanied by the necessary cash. Parties answering these advertisements must write to the addresses given, as the Publishers decline to furnish any information concerning them.]

Salesman Wanted.

An experienced ice machine salesman having good references, can obtain a good position by addressing "C. M. A.," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Ice Machine Wanted.

Wanted, a 20 to 25-ton second-hand ice machine. Parties answering will please give full particulars. Address "Oil," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Foreman Wanted.

A first-class foreman with $10,000 to invest in a good paying ice factory in Kentucky. Address, with references, "Ice Factory," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Second Hand Ice Machine for Sale.

A second-hand ice machine, in first-class running order. Ice making capacity, twenty tons of ice per day. Will sell for $10,000. Address S. P. F., care of ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Situation Wanted

An experienced engineer wishes to secure a situation in a northern state to run an ice or refrigerating machine. Understands the business thoroughly. Address "James W. M.," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Situation Wanted.

Wanted, a situation by a machinist who has had charge of the erection of ice and refrigeration plants for the past eight years with one of the largest eastern manufactories, in the same position, or would take charge of refrigerating or ice making plant. Address "Machinist," Room 96, Flood Building, San Francisco, Cal.

Engineer and Manager for Ice Factory Wanted.

A head engineer and manager for an ice factory of 30 tons capacity, of latest patent, in one of the Middle States. The party wanted must have practical experience in arranging and running cold storage of any kind; must be energetic and able to run the works in the most economical way. A party with some money has a chance to get an interest in the concern, if he is the proper man for the place. This factory has been in operation for many years, and has paid good dividends. Best references are required. Address "Engineer," care of ICE AND REFRIGERATION, 177 La Salle street, Chicago.

For Sale.

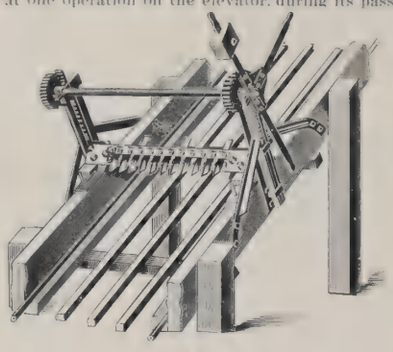
On account of broken health, will dispose of my cold storage plant and business referred to on page 79, August number of this magazine. Been in successful operation five years. Storage capacity over 3,000 cases of eggs, or their equivalent. On paved street, with side track in rear. Near center of produce trade, and has every facility for carrying on commission business in connection with cold storage. Any man having money to run this plant and business properly, can clean up from $10,000 UPWARD in clear profits YEARLY, according to his push and energy. Cost, $8,000; will discount for cash, or trade for real estate. For particulars, write D. B. Beemer, 807 Howard street, Omaha. Population, 140,000.)

Situation Wanted.

Situation wanted by a thoroughly competent engineer. Has had six years' experience with compression ice machines, running and erecting, both can and plate systems; holds a chief engineer's certificate of ocean steamers; is familiar with the steam engine indicator and its application to ammonia pumps; is a practical machinist and a fair draughtsman; has had experience with high speed engines. Would prefer a position erecting for a first-class building firm, but would accept a running job for first-class wages. Can refer to last employers. Address "Frigidity," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Briggs' Corrugating Elevator Plane

For reducing ice to an even thickness and corrugating it upon the upper surface at one operation on the elevator, during its passage from the water to the house.



It will cut off any amount necessary, leaves the top of the cakes dry and slightly corrugated. It gives level floors, and the ice can be stored with less labor and will come out very much easier and with less breakage than if not planed and corrugated.

CAUTION.

Planes using cutters which have cutting edges that diverge from the entering point of the cutters, whether made singly or in sections, infringe my rights under letters patent, the users of which I shall hold liable to me in damages.

JOHN N. BRIGGS, Coeymans, Albany Co., N. Y.

PETER GERLACH & CO.

CLEVELAND, OHIO.

MANUFACTURERS OF THE FINEST

ICE TOOLS

.....FOR.....

HARVESTING . .
STORING . . . .
AND DELIVERING ICE.

SEND FOR PRICE LIST.

THE CANTON STEEL ROOFING CO.

.....MANUFACTURERS OF.....

ICE FREEZING CANS

Insulating and Sheathing Papers, . .
Steel Roofing, Corrugated Iron, . . .
Eaves Trough, Conductor, Etc. . . .

Canton, Ohio.

ICE FACTORY FOR SALE

A first-class Ice Factory in a prosperous and growing town in Kentucky. Capacity, 30 tons daily. Good trade and fair prices. Will be sold cheap for cash. Good reasons for selling.

For further particulars, address

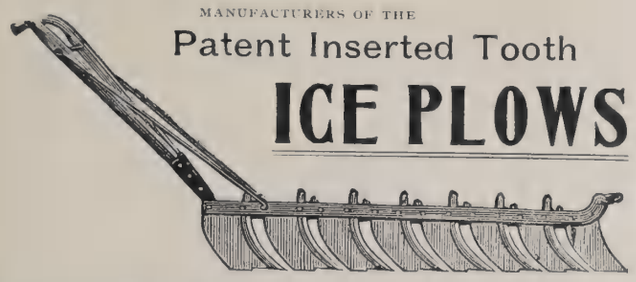
ICE FACTORY,
177 La Salle Street, Chicago.
Care ICE AND REFRIGERATION.

J. G. BODENSTEIN & CO.

MANUFACTURERS OF THE

Patent Inserted Tooth

ICE PLOWS



OLD STYLE PLOWS, AND ALL OTHER ICE TOOLS

Before purchasing elsewhere send for our descriptive catalogue and price list.

STAATSBURG, N. Y.

Engineers Who Write

to us will always receive valuable information in regard to reducing Valves, Pump Pressure Regulators and Pump Governors, which we manufacture. These are standard goods, of the best material and workmanship, on the market. We also manufacture an iron reducing valve, suitable for use on an ammonia apparatus.

MASON REGULATOR CO.

BOSTON, MASS.



THE CHEF.

McCray Refrigerator AND Cold Storage Co.

KENDALLVILLE, IND.

MANUFACTURERS AND BUILDERS OF ALL KINDS OF

REFRIGERATORS AND COOLING ROOMS

WRITE FOR CATALOGUE AND PRICES.

Special Attention for Ice Cold Storage Buildings.

CHICAGO OFFICE,

Loomis Building, Clark and South Water Streets.

AUG. MARITZEN,

Engineer and Architect

WILL FURNISH ON SHORT NOTICE ALL PLANS, SPECIFICATIONS AND ESTIMATES FOR COMPLETE . . .

COLD STORAGE HOUSES,
ICE FACTORIES,
ICE HOUSES,
BREWERIES, MALT HOUSES,
GRAIN ELEVATORS,
WAREHOUSES,
DISTILLERIES,
ENGINE AND BOILER HOUSES,
ETC., OR ANY OF THEIR SPECIAL PARTS.

And also for Remodeling and Improvements in Old Buildings, Etc.

ROOMS 40, 42, 44, 46, 48, No. 177 LA SALLE STREET,

CORNER MONROE,

Chicago, Ill.

BEST OF REFERENCES FURNISHED AND SATISFACTION GUARANTEED. . . . .

DIRECTORY OF

Ice Factories, Ice Dealers and Cold Storage Houses.

THE PICTET ICE WORKS,
Manufacturers of Artificial Ice from Filtered and Double Distilled Lake Erie Water.
Capacity, 30 tons per day.
20, 22 & 24 Center St., Cleveland, O.

THE WASHINGTON MARKET CO.
Central, accessible and close to business, with over 300,000 feet cold storage space.
Center Market: 7th and Pa. Ave., N. W.,
Washington, D. C.

CENTRAL ICE CO.
REPRESENTING Lookout Ice & Cold Storage Co.
Chattanooga Ice & Bottling Co.
Ice Capacity, 125 Tons daily. Big Spring Ice Co.
Chattanooga, Tenn.

NORTHWEST COLD STORAGE & ICE CO.
WM. MCGUIRE, Sec'y and Treas.
C. H. PRESCOTT, Pres. J. C. LEWIS, Vice-Pres.
WM. MCGUIRE, Mgr. Portland, Ore.

STANDARD ICE CO.
Daily capacity, 135 tons.
Office: Wall Street.
Factories: Atlanta, Iceville and West End.
MORRIS BENJAMIN, Mgr. Atlanta, Ga.

J. WALTON CURTIS,
ICE BROKER,
Ice bought and sold on commission.
P. O. Box 1264. Boston, Mass.

EXCELSIOR ICE & COLD STORAGE CO.
Ice capacity, 80 tons daily,
W. H. HOWE, Prop. Nashville, Tenn.

GEORGIA ICE CO.---N. O. ICE MFG. CO.
Capac'y, 40 tons daily. Capac'y, 80 tons daily.
J. M. BEATH, Gen. Mgr. H. H. BLANK, Supt. N. O.
Atlanta, Ga. New Orleans, La.

JAMES McCARTHY & SON,
Wholesale and Retail dealers in Ice.
Winter and Summer Shipments.
Lake Bras D'Or, Nova Scotia.

GIFFORD BROS.

HUDSON, NEW YORK.

ICE

ELEVATING
CONVEYING
LOWERING

Send for Catalogue and Price List.

MACHINERY

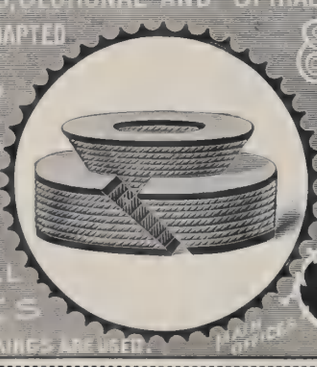
ALSO

CHAIN, FORGINGS, ENGINES AND BOILERS.

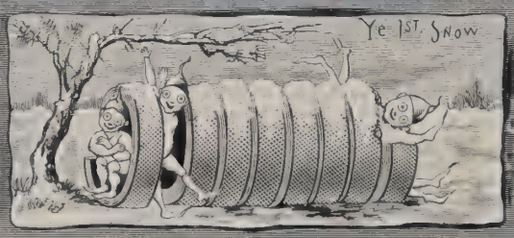
THE GARLOCK PACKING CO.

ELASTIC RING, SECTIONAL AND SPIRAL PACKINGS
ESPECIALLY ADAPTED FOR STEAM, WATER, AMMONIA AND ALL PLACES WHERE PACKINGS ARE USED.

EQUALED BY NONE









PALMYRA, N.Y. ROME, GA. OMAHA, NEB. | PITTSBURGH 54, 5th AVE | NEW YORK 194 WATER ST. | CHICAGO 94 FRANKLIN ST. | PHILADELPHIA 22 & 24 N. 4th ST. | PORTLAND, ORE.

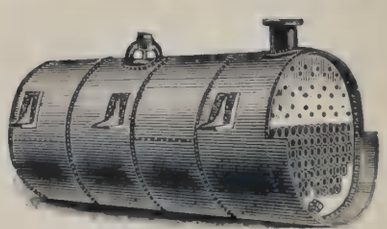
LANSING-IRON AND ENGINE-WORKS

LANSING, MICH.

MANUFACTURERS OF

COMPOUND
CONDENSING
AUTOMATIC
ENGINES.

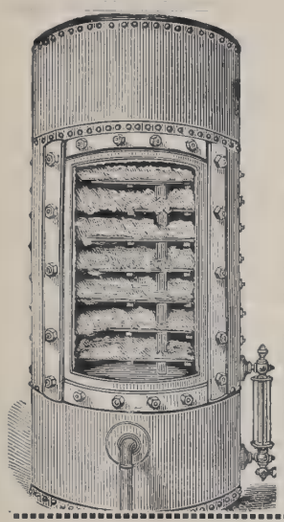




CORRESPONDENCE SOLICITED

BOILER AND SHEET IRON AND TANK WORK

For Ice Makers and Cold Storage Plants a Specialty.



NEW FEED-WATER PURIFIER AND HEATER

USES LIVE STEAM

This cut shows our Feed Water Heater and Filter combined. Perfectly purifies the feed-water and delivers it to the boiler freed from scale producing elements and sediment. FULLY GUARANTEED.

STILWELL'S PATENT IMPROVED

Lime Extracting Heater. Uses Exhaust Steam. Separates the oil from the Steam and Water. It Regulates the Feed. The Pipes Never Pound. Prevents Scale in Steam Boilers, removing all Impurities from the water before it enters the Boiler.

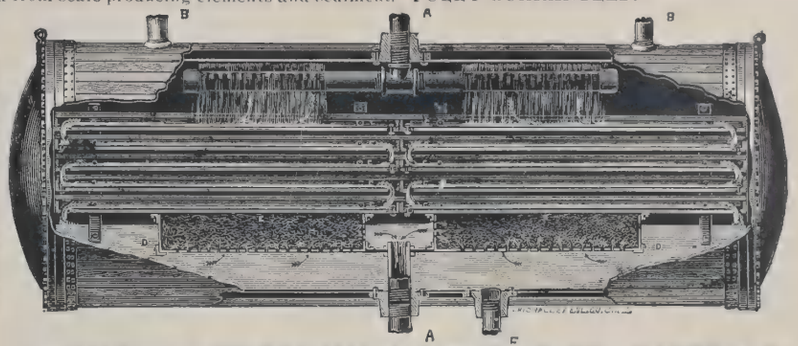
THOROUGHLY TESTED.

Over 4,500 of them in daily use.

This upright view is a fac-simile of the appearance of the shelves of a No. 5 Heater at work on ordinary Lime Water, when the door was removed after the Heater had been running two weeks.

ILLUSTRATED CATALOGUE FREE.

ESTABLISHED IN 1866.



STILWELL & BIERCE MANUFACTURING CO., DAYTON, O.

FOREST CITY PACKING CO.

MANUFACTURERS OF

HIGH GRADE AMMONIA AND ENGINE PACKING . . .

69 FRANKFORT,

CLEVELAND, OHIO.

A. W. SWANITZ, CONSULTING ENGINEER,

AND EXPERT IN

Ice AND Refrigerating Machinery

CORRESPONDENCE SOLICITED . . .

701 STOCK EXCHANGE BUILDING,

CHICAGO.

TANKS AND SHEET IRON WORK

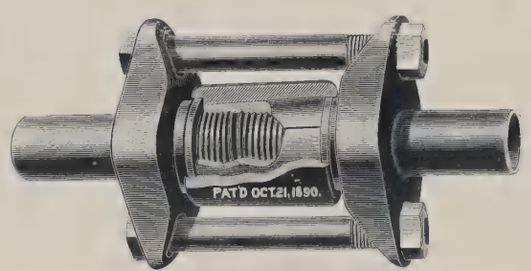
OF EVERY DESCRIPTION.



CONTRACT FOR THE COMPLETE EQUIPMENT OF

ICE MAKING AND COLD STORAGE PLANTS.

THE CLIMAX COUPLING



A NEW AND ORIGINAL INVENTION.

Unsurpassed for Efficiency, Strength, Durability and Economy. Investigation will establish its superiority over every other known pipe-joint, particularly for Ice and Refrigerating Plants using ammonia. For further information, testimonials, prices, etc., address

ENOCH LAWSON,

229 FULTON STREET, SAN FRANCISCO, CAL.

STROMBERG, ALLEN & Co.

RAILROAD AND COMMERCIAL Printers

ENGRAVERS
LITHOGRAPHERS
ELECTROTYPERS

MANUFACTURERS OF

LIGHT RAILROAD SUPPLIES

Consecutively Numbered Tickets, Bonds, Checks, etc., a specialty

PRINTERS OF ICE AND REFRIGERATION

337 AND 339 DEARBORN ST., CHICAGO



AUG. OHLSEN. JOS. MECKLER.

QUEEN CITY Omnibus and Wagon MFG. CO.

Builders of all Kinds of Vehicles.

Cor. Charles and Plum Sts.,

CINCINNATI, O.

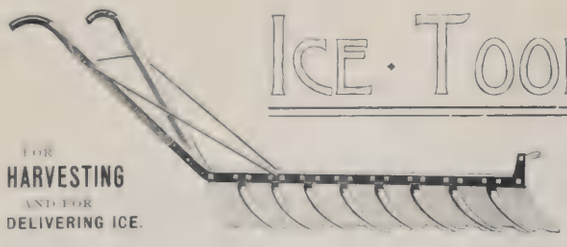
SELDEN'S PATENT PACKINGS

FOR STUFFING BOXES



The BEST Packing for Ammonia, Air, Steam or Water. Used in Ice and Refrigerating Plants in this and other countries. Give it a trial. If your supply store does not keep it in stock, ask him to get it from the manufacturer.

RANDOLPH BRANDT,
38 Cortlandt St.,
New York, U. S. A.



ICE TOOLS

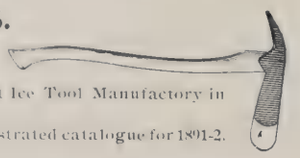
FOR HARVESTING AND FOR DELIVERING ICE.

Of Every Description.

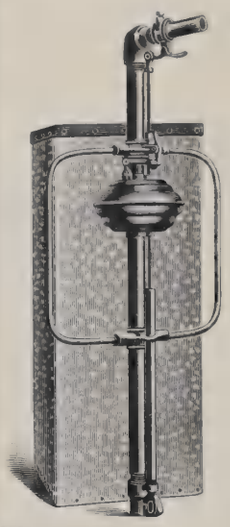
MANUFACTURED BY WM. T. WOOD & CO.

ARLINGTON, MASS.





The oldest and largest Ice Tool Manufactory in the United States.
Send for complete illustrated catalogue for 1891-2.



E. C. SAULS. C. G. SAULS.

SAULS BROS.

MANUFACTURERS OF

Sauls' Automatic Ice Can Filler

Fills Automatically and prevents flooding the bath. Save time, labor and money. Over

: : 150 : :

In use in prominent factories. Send for testimonials and prices.

SAULS BROS.

COLUMBUS, GA.

CRANE COMPANY, CHICAGO.

SPECIAL **WROUGHT IRON PIPE**

. . . . . For Ice Making and Cold Storage.

SEIBEL-SUESSDORF

COPPER AND IRON MFG. CO.

MANUFACTURERS OF

Sheet Iron Tank Work

Also Manufacturers of Galvanized Iron . .

FOR ICE FACTORIES, PACKERS, ETC.

ICE CANS

SEND FOR ESTIMATES.

N. E. CORNER SECOND AND LOMBARD STREETS. ST. LOUIS, MO.

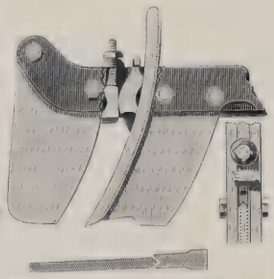
ICE TOOLS

HENRY BODENSTEIN,

Successor to J. G. & H. Bodenstein.

MANUFACTURER,

Staatsburg, Dutchess Co., N. Y.



MANUFACTURER OF THE

PATENT **Inserted Tooth Ice Plow**

PAT. EXTENSION GAUGE

AND ALL OTHER ICE TOOLS.



Repairing Promptly and Neatly Executed.

All Work Warranted to Give Satisfaction.

HILPERT & CHANDLER

ENGRAVERS

BY ALL PROCESSES.

REFER TO CUTS IN THIS PAPER FOR SPECIMENS OF WORK.

167 DEARBORN ST. CHICAGO.

Mineral Wool

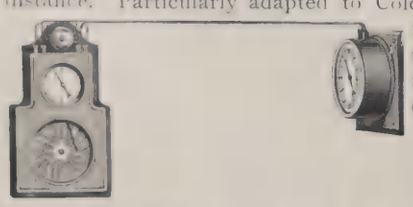
BEST INSULATOR FOR . . . . .

ICE HOUSES, COLD STORAGE ROOMS, ETC.

REFERENCES ON APPLICATION. SAMPLES FREE. . . . . **U. S. MINERAL WOOL CO.** 2 CORTLANDT ST., N. Y. CITY.

Telemeter Instruments.

For recording and indicating temperature and pressure at a distance. Particularly adapted to Cold Storage, to indicate in the office or engine room the temperature in any or all the refrigerating rooms.

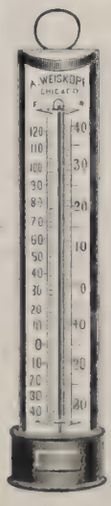


FOR DESCRIPTION AND PRICES SEND TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Courtlandt St. Boston Office, 70 Pearl St.



A. WEISKOPF

111 Fifth Ave., CHICAGO,

. . . . . MANUFACTURER AND IMPORTER OF . . . . .

THERMOMETERS

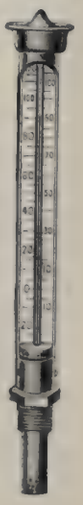
AND HYDROMETERS.

Ice Machine Thermometers and Ammonia Hydrometers . . . .

CELLAR AND . . . . . CHILL ROOM THERMOMETERS.

Thermometers in angle shape made to order from sketch or specification.

ESTIMATES FURNISHED ON APPLICATION.



IMPORTANT TO ICE MAKERS.

TRI-SODIUM PHOSPHATE CHEMICAL WATER PURIFIER.

PATENTED

A staple salt for the purification of water, ***HOT*** or ***COLD,*** free from injurious action to ice, water or metals.
It prevents incrustations in boilers, and yields an absolutely pure steam for condensing and freezing.
It will prevent incrustations or corrosion to cooling coils, when applied to water passing over them.

By its use the impurities are rapidly eliminated from hot or cold water, by precipitation in tanks, producing a clear, soft, wholesome water for freezing or other purposes.

Send for our book "Worth Knowing," containing valuable information on ***Water Treatment.***

KEYSTONE CHEMICAL COMPANY, Patentees and Manufacturers,

3 South Front Street, PHILADELPHIA. — 65 South Canal Street, CHICAGO.

STRONG TESTIMONY

KEYSTONE CHEMICAL CO.

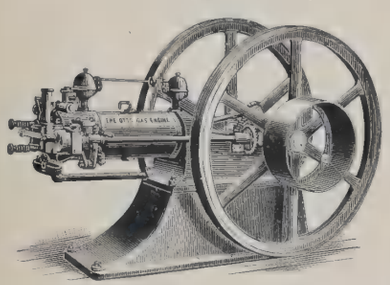
CHAMPION ICE MANUFACTURING AND COLD STORAGE CO.
COVINGTON, KY., June 27, 1891.

Gentlemen: In answer to your inquiry as to how we like your Tri-Sodium Phosphate, will say that we have been using it for two years with the best of results, both here and at our plant in Ironton, O. We find that it keeps our boilers clean, and the condensed steam from them is absolutely pure, and therefore does not affect the ice manufactured from it in the least. Condensed steam from boilers usually carries an insipid, smoky or bitter flavor with it into ice, but this is entirely overcome. We have the reputation of having the best artificially manufactured ice in this country; it is clear, odorless and tasteless, in fact absolutely pure, and we "bank" our last dollar on your Tri-Sodium Phosphate

Yours truly,
CHAMPION ICE MFG. & COLD STORAGE CO.
(COPY) R. W. DUGAN, Sup't and Treas.

OTTO
Gas and Gasoline Engines

OVER 33,000 IN USE



BEST AND CHEAPEST POWER FOR

Refrigerating Machines

No Skilled Attendance.
No Boiler, Heat or Danger.
Started at once for short or long duty.
Sizes, ½ to 100 horse-power.
Can be used in country or city.

OTTO GAS ENGINE WORKS, 33d and Walnut Sts., PHILADELPHIA. 151 Monroe St., CHICAGO.

....THE....
HEERDEGEN WATER INDICATOR

We make investigations for subterranean water and furnish reports as to the number of streams, their exact width, direction of flow, approximate depth below the surface, and quantity of flow.

The great advantage of having a well located, is:

1. We locate wells only at such places where we find subterranean FLOWING streams; this is a full guarantee of getting wells, which will never drop off or give out in time of drought, which is the case where wells are supplied by seepage water only.
2. We can follow the course of a subterranean stream for any distance and select the proper place to sink the well.
3. We state the approximate depth of the stream below the surface, which enables our customers to make an estimate of the cost for sinking the well by the foot.
4. Where the supply of an ARTESIAN WELL is obtained from a running stream or a spring, instead of seepage water, in NINE CASES OUT OF TEN IT IS OF GOOD QUALITY.
5. If there are any springs in the neighborhood where a well is wanted, we can trace the underground outlets of same or the supplying flow for any distance.
6. Where water of low temperature is wanted for cooling purposes, such as for BREWERIES, ICE FACTORIES, distilleries, oil refineries, etc., none cooler than artesian well water exists.
7. Our method of locating wells eliminates all and every risk of failure.

Estimates are given for sinking wells, with guarantee of water, where supply from artesian wells is desired.

We have successfully located a large number of wells.

For particulars apply to

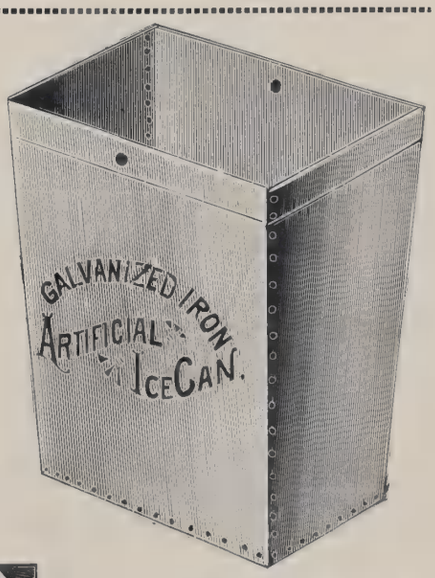
HEERDEGEN & SCHNEE,
48 EXCHANGE PLACE, - - - NEW YORK.

CAPACITY 300 PER DAY.

ICE

"CANS" GALVANIZED IRON
WE MAKE THEM BY THE THOUSANDS FOR ICE MFRS. BREWERS AND FOR THE TRADE
READ TESTIMONIALS.

WRITE FOR PRICES



NEWBURGH, N. Y., November 20, 1890.

I desire to say that I am pleased with the Ice Cans you have furnished me and they have proved satisfactory to my customers.

ROBERT WHITEHILL,
Manufacturer of Engines and General Machinery.

DAYTON, OHIO, November 28, 1890.

The Ice Cans with which you furnished us in the summer of 1890 have been in constant use during the entire Ice Manufacturing season of 1890, giving entire satisfaction. The material and workmanship could not have been better, and to-day the cans are as good as when shipped from your factory. We can faithfully recommend your cans.

C. SCHWIND,
Dayton View Brewery.

SEE TESTIMONIALS NEXT ISSUE.



GROUND FLOOR SPACE 110 X 210 FT.

Established 1861. Incorporated 1890.

THE
KIECHLER MFG. CO.

LINN, EVERETT and CLINTON STS.

CINCINNATI, O.

Insulating Linings

EVERY VARIETY FOR

REFRIGERATORS,
REFRIGERATOR CARS
AND COLD STORAGE.

Sectional Pipe Coverings

FOR AMMONIA AND BRINE PIPES IN ICE AND REFRIGERATING MACHINES.

SEND FOR SAMPLES AND PRICES.

H. F. WATSON CO., ERIE, PA.

NEW YORK. PHILADELPHIA. CHICAGO.

THE B. F. GOODRICH CO.

AKRON RUBBER WORKS,
AKRON, OHIO.

MANUFACTURERS OF

MECHANICAL RUBBER GOODS

HOSE OF HIGH QUALITY

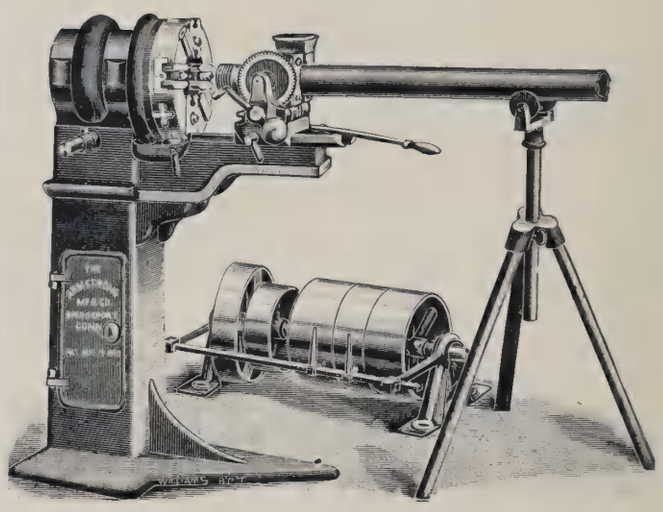
FOR

ICE FACTORIES
AND COLD STORAGES

Rubber Rings for Ice Machines of all Kinds,
Belting, Valves, Etc.

SPECIALTIES TO ORDER. Specialties and Prices upon Application.





Acknowledged to be the Best, as attested by Hundreds of Letters from parties having them in use, on file in our office.

CATALOGUES FREE ON APPLICATION.

THE ELECTRIC PIPE BENDING COMPANY

OF

HARRISON, N. J.

ARE NOW PREPARED TO FILL ORDERS FOR

SPIRAL COILS,
ZIG-ZAGS, OVALS,
IRREGULAR SHAPES
OF ANY SIZE AND LENGTH

The work is done by the THOMSON ELECTRIC WELDING AND HEATING PROCESSES, thus giving greatly superior results to any of the old methods.

No injury from over-heating. Welds and Bends as sound as the rest of the pipe. All work promptly executed and guaranteed.

NO BURNT OR
DEFECTIVE WELDS.
NO SCALE.

ADDRESS ELECTRIC PIPE BENDING COMPANY,
HARRISON, N. J.

THE PONTIFEX ICE MACHINE COMPANY,

ROBERT HEWITT, President, 512 West Street, NEW YORK CITY,

ARE PREPARED TO CONTRACT FOR

Ice and Refrigerating Plants of any magnitude, under the Reece, Stanley, Pontifex-Wood and Hendrick systems (Refrigerant, Aqua Ammonia as constructed under special arrangement with this Company by

THE HENDRICK MANUFACTURING COMPANY, LIMITED, CARBONDALE, PA.

The **PONTIFEX-HENDRICK** Ice and Refrigerating Machine is the result of more than fifteen years' experience in such work on the part of Messrs. Pontifex and Wood, Farringdon Works, London, the original builders of the machine in Great Britain and its Colonies, and of the Pontifex Ice Machine Company, American builders, who have somewhat modified the machine to better adapt it for American refrigerating practice. **A Simple, Strong, Durable, Reliable, Economical and Efficient Machine,** particularly adapted for low temperature work, such as the refrigeration of Paraffine Works, Oil Refineries, Freezing and Cold Storage Warehouses, Fish Freezing Houses, Chemical Works, etc. In successful use in **47 Ice Factories** in tropical countries. Over **350** machines in successful operation in Freezing and Cold Storage Warehouses, Breweries, Distilleries, Wineries, Packing Houses, Abattoirs, Dressed Beef Houses and Markets, Dairies and Creameries, Butterine Factories, Yeast Factories, Chocolate and Candy Factories, Hotels and Restaurants, Paraffine and Cotton Seed Oil Refineries, Lard Refineries, Powder and Dynamite Mills. Machines built from **2½** to **100** tons daily refrigerating capacity. Machines guaranteed for material, workmanship and capacity under test. For descriptive circulars, references, detailed specifications, apply either to

THE PONTIFEX ICE MACHINE COMPANY, 512 West Street, NEW YORK. OR THE HENDRICK MANUFACTURING CO., Ltd. CARBONDALE, PA.

CASTLE ICE MACHINERY CO.

MANUFACTURERS OF INDIANAPOLIS, IND.

Absorption Ice and Refrigerating Machines

For all purposes, containing latest improvements, making REGULAR that which before was NOT regular. Our 15-ton Absorber contains over 6,000 square feet of absorbing surfaces, enabling the temperature of absorption to vary from 50 to 110 deg. Fahr. without affecting operations. One foundation for all machinery. Small water consumption. Economical and positive. The machines in use: We refer to Seymour Ice Co. (Ind.) having machine with all improvements.

MAKE YOUR EXHAUST STEAM PRODUCE SILVER DOLLARS

By using it through our New Designed Machine with improvements for Refrigerating, Cold Storage or Ice Making, from 50 lbs. to 3 tons. Using either live or exhaust steam. With non-explosive retort. Automatic. Can be arranged to operate 12 hours each day and perform excellent duty. No extra help required.

CIRCULARS AND ESTIMATES ON APPLICATION.

THEODORE KRAUSCH'S

IMPROVED STANDARD

Ice Machine

AND

REFRIGERATING APPARATUS

ORDERS FOR ALL PRACTICAL SIZES OF Ice and Refrigerating Machines PROMPTLY AND FAITHFULLY EXECUTED.

THE KRAUSCH IMPROVED STANDARD ICE AND REFRIGERATING MACHINE IS ORIGINAL, and differs from any in use, combines great SIMPLICITY with STRENGTH; the design is symmetrical, and is constructed upon true mechanical principles. Its action is horizontal, double, central and self-contained. The ACTION is CENTRAL, no power is transferred from the machine, and consequently all SIDE MOVEMENTS are entirely avoided, which are so injurious in constructions where the steam engine is located beside the gas compressing cylinder and the line of ACTION is DIAGONAL, and all parts continually exposed to concussions, unnecessary wear and tear, and irregularity in working.

THIS MACHINE IS A Complete Practical Success, TECHNICALLY AS WELL AS FINANCIALLY.

THE THEODORE KRAUSCH CO.

122 EAST UTICA STREET,

BUFFALO, N. Y.

The Improved Pontifex-Wood Machine

A MOST ECONOMICAL AND RELIABLE APPARATUS.

Adapted to all classes of Refrigeration, especially where extremely low temperatures are required.

ALSO FOR

MAKING . . . ICE

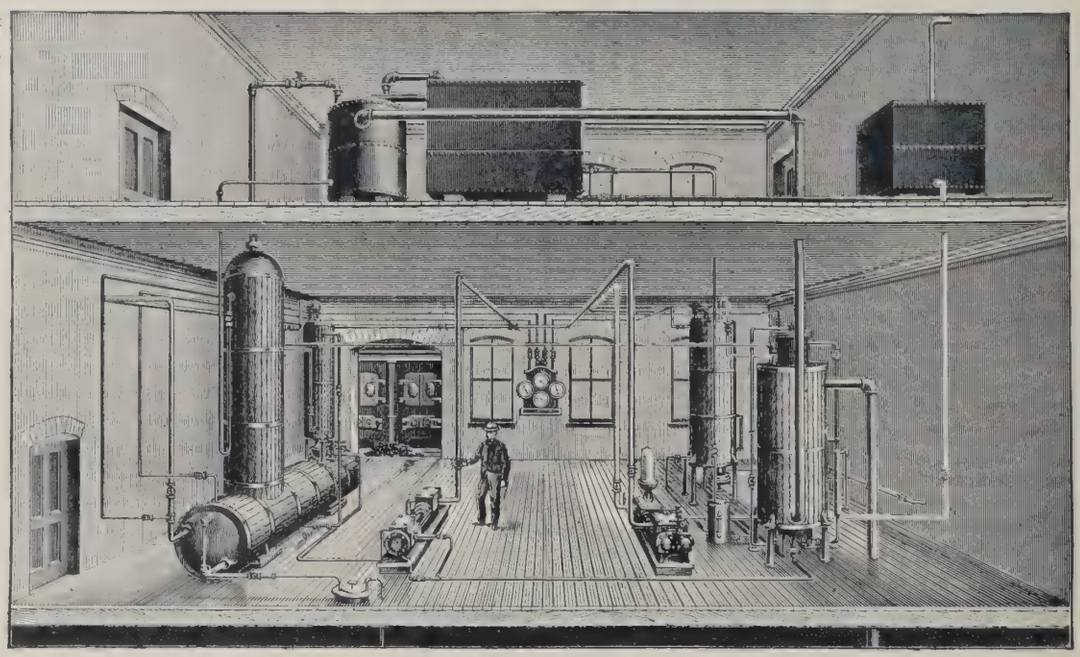
UPWARDS OF

400

MACHINES IN OPERATION.

H. J. W. S. COOKE,
Patentee.

ESTIMATES FURNISHED.
SEND FOR CIRCULARS.



ISBELL-PORTER COMPANY, BUILDERS,

OFFICES

245 BROADWAY, NEW YORK 46 BRIDGE STREET, NEWARK, N. J.

THE RICHMOND ICE MACHINE CO.

MANUFACTURERS OF

THE

MOST IMPROVED

ON THE COMPRESSION PLAN.

Ice-Making and Refrigerating Machinery

A WORD IN YOUR EAR

OUR MACHINES ARE GIVING SATISFACTION AND MAKING THE GUARANTEED AMOUNT OF PURE, SOLID, TRANSPARENT ICE. . . . . .

We have undoubtedly the BEST and SIMPLEST Machine on the Market.

We guarantee the proper working of our machinery. All working parts built to gauge, so they can be readily duplicated, and nothing but the very best material used. Specifications and estimates furnished.

CORRESPONDENCE SOLICITED.

OFFICE, 1105 MAIN STREET,

WORKS . . . .
MANCHESTER, VA.

P. O. BOX 315. **RICHMOND, VA.**

Send for our pamphlet "HOW TO MAKE AN ICE FACTORY PAY."

JOHNSON, McCARTHY & JOHNSON,

MANUFACTURERS OF

THE JOHNSON COMPOUND

Ammonia Compressor

AND

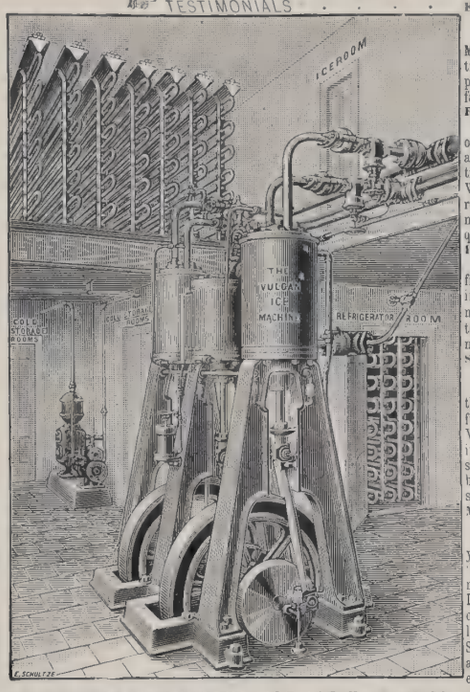
ICE AND REFRIGERATING MACHINES . . . . .

Office, Room 76, Worcester Block,

PORTLAND, OREGON.

The "VULCAN" Ice and Refrigerating Machine,

TESTIMONIALS . . . . .



ENTERPRISE BREWERY, San Francisco:
"The 24-ton Refrigerating Machine has been running continuously since 1887, and has proved economical and satisfactory in every respect."

HOTEL DEL MONTE, Mont'y:
"The Ice Machine now in operation at Hotel Del Monte is and has been since its completion a very satisfactory plant. We take pleasure in cordially recommending this variety of machine to any who may require its use."

HOTEL RAFAEL, San Rafael:
"The 'Vulcan' Ice and Refrigerating plant is satisfactory in every respect, and is doing more work than was guaranteed. A model of good workmanship. The ice is clear."

SOUTH SAN FRANCISCO PACKING & PROV. CO.:
"It gives us pleasure to state that the Refrigerating plant furnished by the Vulcan Iron Works for our packing house, in 1886, has been in operation since then, and has given the best results, to our complete satisfaction."

MILK RANCH, Penn's Grove, Cal.:
"We have been for the past year, and are now using, a 'Vulcan' Refrigerating Machine, manufactured by the Vulcan Iron Works, for the purpose of cooling from 800 to 1,000 gallons of milk per day, shipped to San Francisco and San Rafael, and find the work done by it entirely satisfactory."

THE VULCAN IRON WORKS, 135-145 Fremont St., San Francisco, Cal.

WINGATE & MELL,

MANUFACTURERS OF . . . .

ICE CANS

WRITE FOR ESTIMATES.

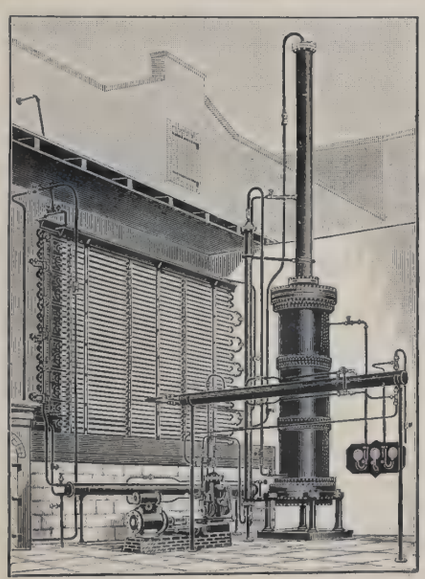
44 & 46 North Broad Street, ATLANTA, GA.

PENNSYLVANIA IRON WORKS COMPANY,

.....MANUFACTURERS OF ....

Ice and Refrigerating Machines

EMBODYING THE LATEST IMPROVEMENTS IN ABSORPTION MACHINES.



Ice Machine References

W. H. RAGAN, Thibodaux, La.
HENRY COOK, Donaldsville, La.
GEO. & J. G. MUEHLEBACH, Kansas City, Mo.
LAUER BREWING CO., Reading, Pa.
STEGMAIER & SON, Wilkes Barre, Pa.
J. H. MICHENER & CO., Philadelphia, Pa.
EDSON BROS. Cold Storage, Philadelphia, Pa.
"GLADSTONE" APARTMENTS, Philadelphia, Pa.
THOS. BRADLEY, Cold Storage, Philadelphia, Pa.
FRAISSI & BLUM, Ice Manuf'rs, Houma, La.

AND MANY OTHERS.

SATISFACTION AT LOWEST COST GUARANTEED.

Plans and estimates for plants erected ready for operation cheerfully given on application.

Office and Works, 50th Street and Merion Avenue,

PHILADELPHIA, PA.

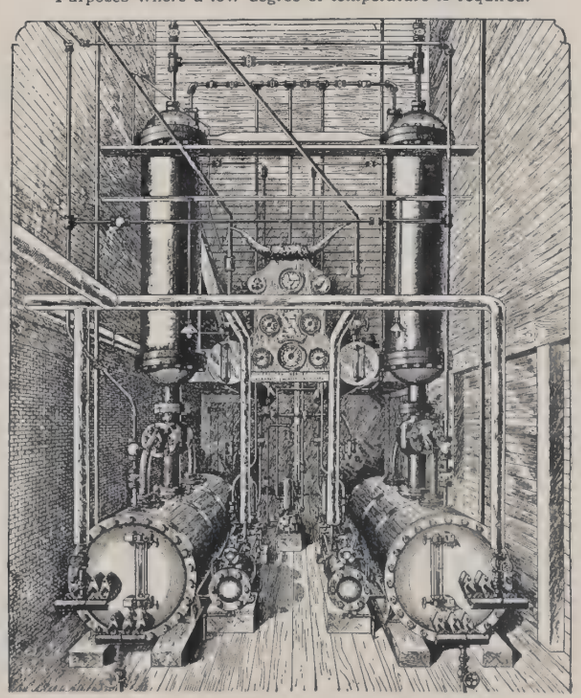
NEW YORK OFFICES, 9 AND 11 WALL STREET.

Ice and Refrigerating Machines

FOR . ICE-MAKING . PLANTS

Brewers, Pork Packers, Oil Refiners, Cold Air Store Houses, and all Purposes where a low degree of temperature is required.

Builder of Machinery for Packers, Butchers and Produce Dealers.



Dealer in Engines, Boilers, Pumps and Steam Specialties.

ENGINEER AND CONTRACTOR

Descriptive Circulars, References, Detailed Estimates and Information furnished on Application . . . . .

The Craft Refrigerating Machine Co.

74 CORTLANDT ST., NEW YORK.

THE WESTERN ICE MACHINE CO.

OTTO HOFFMANN, PROPRIETOR.

Ice AND Refrigerating Machinery

FOR BREWERIES, PACKING HOUSES, ICE FACTORIES,
COLD STORAGE PLANTS, MARKETS, CONFECTIONERS, ETC.

Every Part Accessible While in Motion. . . . . .
The Most Cooling with the Least Expense. . . . . .

THIS machine is the simplest, cheapest in first cost and after expense, is more easily handled than any other, and takes less room. Absolutely no possibility of leaking Ammonia. Machines of any capacity from smallest to the largest. We would be pleased to make Estimates, and believe we can show you a saving in cooling your cellars. . . . . .

WESTERN ICE MACHINE CO.

Office, Room 605 Northern Office Building, Cor. La Salle and Lake Sts.,

See this space next issue for Illustration of Machine.

CHICAGO, ILL.

ICE MACHINES

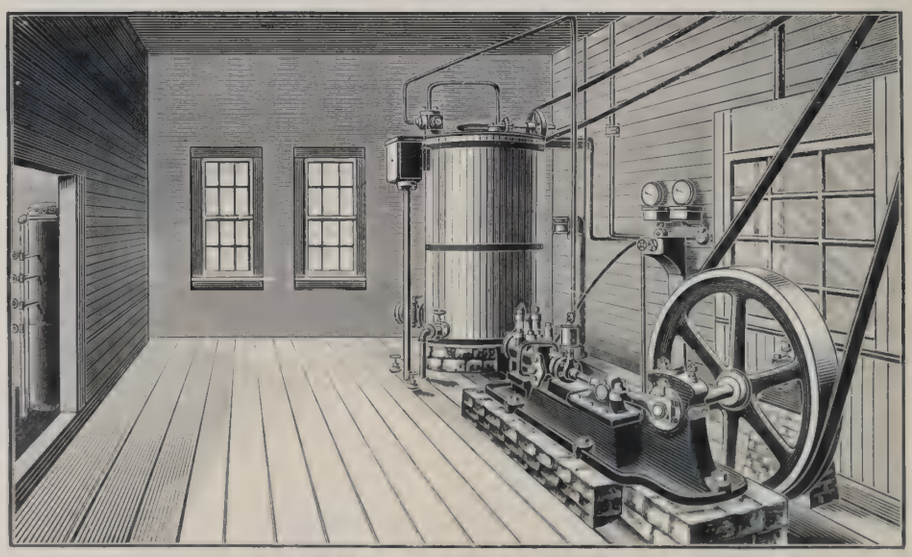
(WINDHAUSEN'S SYSTEM.)

AINSLIE, COCHRAN & CO.

LOUISVILLE, KY.

To the Trade . . . .

We have recently secured the sole right to manufacture and sell WINDHAUSEN'S CARBONIC ANHYDRIDE ICE AND REFRIGERATING MACHINES in the United States. These machines have gained a wide reputation on the continent for their simplicity, durability and economical running. They have been indorsed by the German government, an eighty (80) ton machine having been placed in the powder works at Spandau. They are also fast superseding other systems in the prominent breweries of Germany, nearly 200 being in operation already. They are the only machines using carbonic anhydride, which has such a great range of expansion, produces such intense cold, and is cheap, odorless and easily obtained



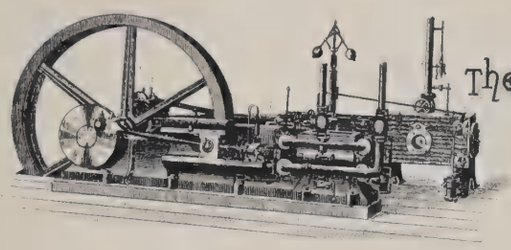
The above cut represents the No. 2 Machine at the Terre Haute House, Terre Haute, Ind.

WRITE TO US FOR FURTHER PARTICULARS

AINSLIE, COCHRAN & CO.

REFRIGERATING PLANTS

THEO. O. VILTER, Prest. & Supt.
ALBERT WALLBER, Vice Prest.
WM. O. VILTER, Secy. & Treas.



The Weisel & Vilter Mfg. Co.

Manufacturers of

CORLISS ENGINES,
Machinery for Brewers and Bottlers.

ICE MAKING & REFRIGERATING MACHINERY.

ICE-MAKING PLANTS

FOR BREWERIES, PACKING HOUSES, CONFECTIONERIES, COLD STORAGE HOUSES, ETC.

Direct Expansion or Brine System

MILWAUKEE, WIS.

Van Winkle Gin and Machinery Co.

E. VAN WINKLE, President.
J. WALLACE BOYD, Secretary.

MANUFACTURERS OF

THE KEELING
..AUTOMATIC..
ICE MACHINE

FOR ICE MAKING, COLD STORAGE PLANTS, BREWERIES, PACKERS, ETC.

WRITE FOR ESTIMATES AND FURTHER INFORMATION.

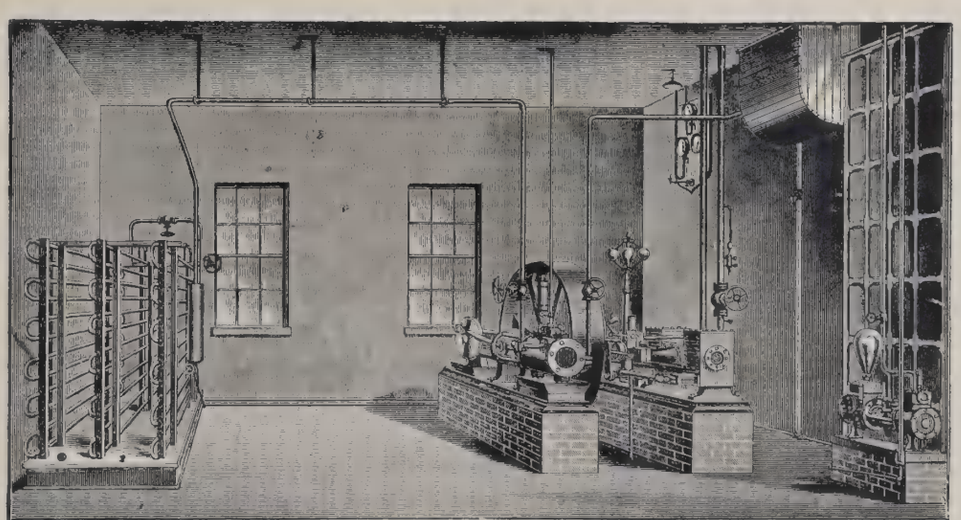
VAN WINKLE GIN AND MACHINERY CO.

OFFICE, 210 MARIETTA STREET, ATLANTA, GA.

The American Ice Machine Company

SOLE OWNERS OF THE
KLINE AND WINKLER AUTOMATIC

REFRIGERATING AND
ICE MAKING MACHINE SYSTEM



Simplicity of Construction,
Durability,
Efficiency,
Economy.

ICE-MAKING OR
REFRIGERATING
PLANTS

From One Ton to Two Hundred Tons daily capacity.

Over 100 MACHINES IN OPERATION.

1. **The simplicity of construction.** Every part is simple and complete, is exposed to full view, easily got at and can be readily understood and handled by an engineer of ordinary intelligence.

2. **The freezing process is completely automatic** (WHICH NO OTHER FREEZING SYSTEM POSSESSES), through the action of our patent evaporation pressure regulator; it saves valuable working time. Every part is independent of the other, and can be overhauled or replaced without stopping the whole machine.

3. **That ice is manufactured from distilled water,** which is free from disease-producing germs, such as abound in ice frozen on rivers and ponds, is chemically pure, and is infinitely preferable to the natural product.

4. **Our Patent Gas Condenser enables us to work with warmer water and less water** than any other machine, as the water is applied DIRECT on the hot pipe without waste or slop on the surroundings.

5. **We can make more ice or cold air** than any other machine, WITH THE SAME AMOUNT OF FUEL. Experts have placed the difference in our favor at not less than 25 per cent.

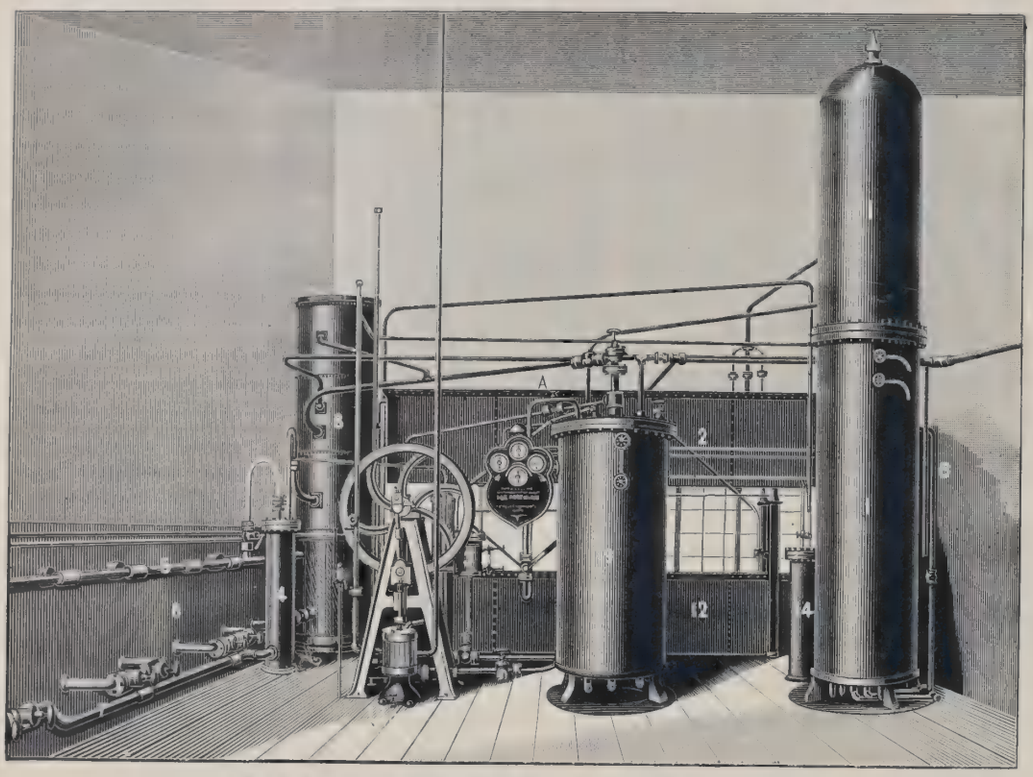
6. **The Condensers and Freezers** will not stop on account of sediment. They never require cleaning. They clean themselves while at work without separate attachment. Our freezing coils are so constructed that no pipe joint is used inside of the tank, and each coil is independent of the other. Each coil section can be taken out while working without interference with the other sections.

Company's Offices, 35 Broadway, Rooms 72, 73, 74 and 75, New York.

COLUMBUS IRON WORKS

IMPROVED

Absorption Ice Machine



SUCCESSORS TO
H. D. STRATTON & CO.

Established 1853.
Incorporated 1856.

W. R. BROWN, President.
W. COOK, Superintendent.

Machines from 5 to 33 tons capacity per 24 hours, or larger if desired.

94 Machines Built
and all in successful operation

More Ice Making Machines sold in the South than by any other establishment.

No expensive building required. No pressure on machine when stopped.

Send for price list and illustrated circular with location of machines.

This establishment was the first to turn out a perfect and complete Ice Machine, and has been in the business 21 years, constantly manufacturing and improving, and are prepared to furnish the most reliable and economical machine in the market.

BUILT BY THE . . . **COLUMBUS IRON WORKS CO.** COLUMBUS, GA.

BUFFALO . . . . REFRIGERATING MACHINE CO.

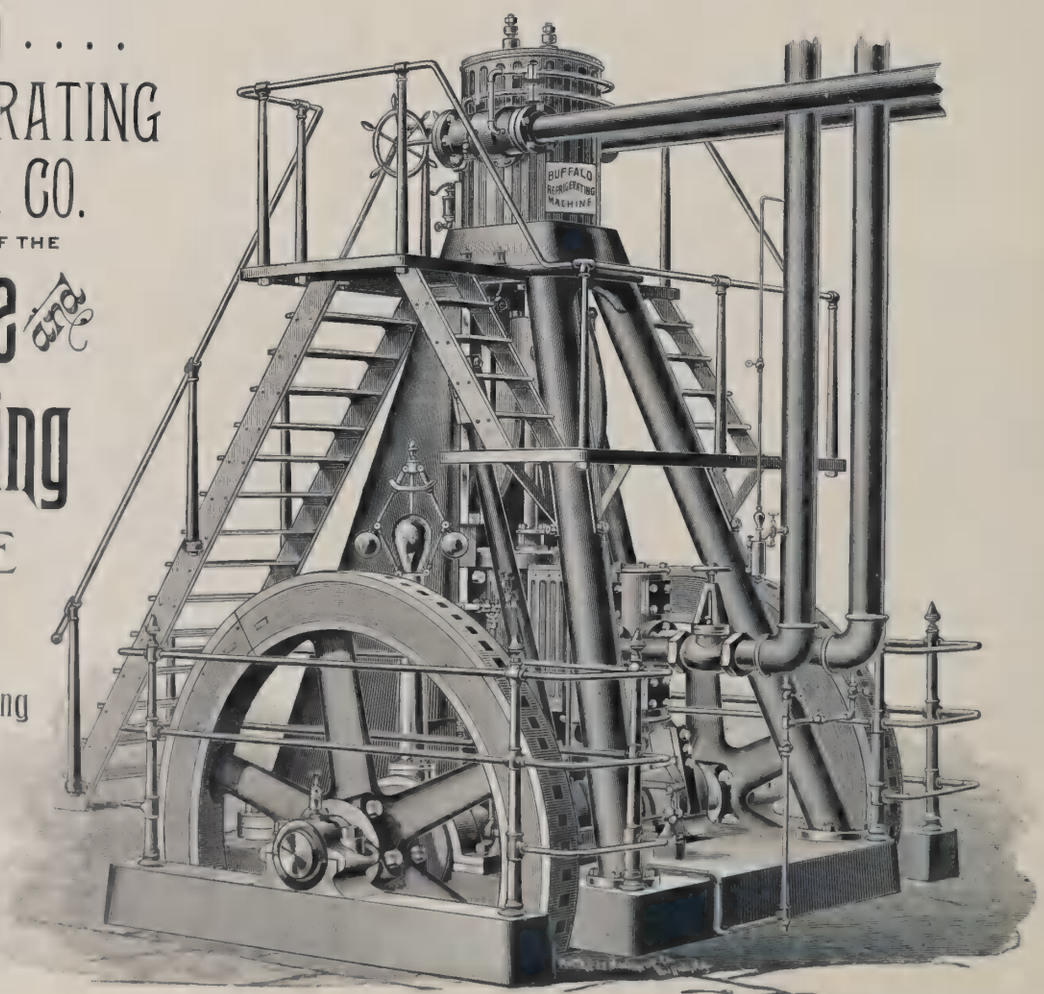
BUILDERS OF THE

Buffalo Ice and Refrigerating MACHINE

For Ice Making and Artificial Refrigerating

Full particulars, Estimates, Illustrated Circular, containing list of machines in use, etc., furnished upon application

Buffalo, N. Y.



THIS ENGRAVING REPRESENTS THE WORKS OF THE

Blymyer Ice Machine Co., Cincinnati, Ohio.

Manufacturers of Ice and Refrigerating Machines, exclusively. The Absorption Machine, made by the Blymyer Ice Machine Co., is superior to any Compression Machine, either as a Refrigerating or Ice-Making Machine. It requires no steam engine or complex moving machinery. It saves 25 to 40 per cent of the fuel, and saves ammonia and labor. The cost of repairs is small, and the machine will outlast Compression Machines several times over. It is not necessary to buy these machines in pairs, as there is no danger of serious stoppage. These machines are ***RADICALLY DIFFERENT*** from all other Absorption Machines, and are in every way superior to them.



BELOW will be found a list of Ice-Making and Refrigerating Machines made by us. Every one of these machines has been in continuous use since erected, and is in use now. None have failed to fill their guarantees satisfactorily; none have been superseded by other machines. The entire capacity of our works having, up to the present time, been taken up with the manufacture of Ice-Making Machines, no agents have solicited orders for Refrigerators. Such orders as have been taken have been merely incidental. Having easily taken the lead in the Ice-Making Machine field, the manufacturers, with their enlarged capacity, will now enter the Refrigerator field (which is much the easier of the two in which to make a good record) in earnest, and respectfully solicit correspondence. Send for our catalogue.

ICE-MAKING MACHINES.

No.	Size.	NAME.	ADDRESS.
1	8 Ton.	Meridian Ice Mfg. Co.	Meridian, Miss.
1	10 "	Baton Rouge Ice Mfg. Co.	Baton Rouge, La.
1	15 "	Evansville Ice and Cold Storage Co	Evansville, Ind.
1	5 "	A. Moresi	Jeanerette, La.
1	15 "	Lookout Ice and Cold Storage Co.	Chattanooga, Tenn.
1	10 "	Morris Ice Co.	Jackson, Miss.
1	15 "	Texarkana Ice Co.	Texarkana, Tex.
1	30 "	Lookout Ice & Cld. Stor. Co. (2d Order)	Chattanooga, Tenn.
1	5 "	Gadsden Ice Co.	Gadsden, Ala.
1	6 "	Sheffield Ice Co	Sheffield, Ala.
1	5 "	Decatur Ice Co	Decatur, Ala.
1	30 "	Crystal Ice Co.	Wichita, Kan.
1	3 "	Denton Ice Co	Denton, Tex.
1	5 "	Van Buren Ice and Coal Co.	Van Buren, Ark.
1	5 "	Biloxi Artesian Ice Mfg. Co.	Biloxi, Miss.
1	25 "	Hutchinson Ice Mfg. Co.	Hutchinson, Kan.
1	12 "	Parkersburg Ice Co.	Parkersburg, W.Va.
1	30 "	Union Ice Co.	Denver, Col.
1	3 "	Dominick & Karston	West Point, Miss.
1	3 "	DeCoppet Ice Co.	Somerset, Ky.
1	35 "	Evansv'le Ice & Cld.Stor.Co.(2d Order)	Evansville, Ind.
1	2 "	Van Horn & Chambers	Lebanon, Ohio.
1	4 "	John C. Webb	Demopolis, Ala.
1	12 "	Huntington Ice and Storage Co.	Huntington, W.Va.
1	15 "	Corryville Artificial Ice Co.	Cincinnati, Ohio.
1	3 "	Tupelo Ice Co	Tupelo, Miss.
1	30 "	Wheeling Ice and Storage Co.	Wheeling, W.Va.
*1	10 "	Ft. Payne Ice and Cold Storage Co.	Ft. Payne, Ala.
*1	10 "	Coronado Beach Co. (Hotel del Coronado)	San Diego, Cal.
*1	1 "	Walter Aiken (Hamilton Hotel)	Hamilton, Bermuda
*1	20 "	Decatur Cold Storage and Ice Co.	Decatur, Ill.
*1	12 "	Marietta Ice Co	Marietta, O.
*1	35 "	Dayton Ice Mfg. & Cold Storage Co	Dayton, O.
*1	30 "	Zanesville Artificial Ice Co.	Zanesville, O.
*1	35 "	Evansv'le Ice & Cld.Stor.Co.(3d Order)	Evansville, Ind.
*1	3 "	Connolly & Curtis	Columbus, Miss.
*1	5 "	Lebanon Artificial Ice Co.	Lebanon, Ky.
*1	5 "	Cynthiana Elec. Light & Power Co	Cynthiana, Ky.
*1	5 "	Grenada Cream'y, Cld. Stor. & Ice. Co	Grenada, Miss.
*1	15 "	Washington Ice Co	Washington, Ind.
*1	30 "	Wheeling Ice & Storage Co. (2d Order)	Wheeling, W.Va.
*1	32 "	Consumers Ice Co.	San Francisco, Cal.
*1	15 "	Shelbyville Artificial Ice Co	Shelbyville, Ind.
*1	30 "	Pueblo Distilled Water Ice and Cold Storage Co.	Pueblo, Col.
*1	15 "	Skinner & Olson	Topeka, Kan.
*1	35 "	Fort Wayne Artificial Ice Co.	Fort Wayne, Ind.
*1	35 "	Evansv'le Ice & Cd.Stor.Co. (4th Order)	Evansville, Ind.
*1	55 "	Dayton Ice Mfg. & Cd. Sto. Co. (2d Order)	Dayton, O.
*1	15 "	Ashland Artificial Ice Co.	Ashland, Ky.
*1	50 "	Corryville Artificial Ice Co. (2d Order)	Cincinnati, O.

* These machines were erected in 1890.

ICE-MAKING MACHINES.

No.	Size.	NAME.	ADDRESS.
**1	8 Ton.	Gibson House	Cincinnati, O.
**1	10 "	Palace Hotel	San Francisco, Cal.
**1	30 "	The People's Ice Co.	Birmingham, Ala.
**1	35 "	Citizens Ice Co.	Los Angeles, Cal.
**1	20 "	Civill & White	Colorado Spr'gs, Col.
**1	30 "	Pueblo D.W. Ice & Cd.S.Co. (2d Order)	Pueblo, Col.
**1	60 "	Colorado Ice and Storage Co.	Denver, Col.
**1	25 "	E. B. Cornell	Tampa, Fla.
**1	5 "	Mr. H. G. Meumann	Bessemer, Ala.
**1	20 "	Consumers Ice Co.	Vicksburg, Miss.
**1	35 "	Artificial Ice and Storage Co.	Canton, O.
**1	12½ "	Frigid Ice Mfg. Co.	Joplin, Mo.
**1	30 "	Crystal Ice Co.	Albuquerque, N. M.
**1	15 "	Meridian Ice Co. (2d Order)	Meridian, Miss.
**1	5 "	Dayton Ice Co.	Dayton, Tenn.
**1	15 "	Decatur Ice Co. (2d Order)	Decatur, Ala.
**1	12½ "	The Ruddick Artificial Ice Co.	Columbus, Ind.
**1	10 "	Mr. August Erath	New Iberia, La.
**1	55 "	The Crystal Ice Mfg. & Cd. Sto. Co.	Columbus, O.
**1	32 "	Consumers Ice Co. (2d Order)	San Francisco, Cal.
**1	15 "	Peru Ice and Cold Storage Co.	Peru, Ind.
**1	55 "	The Crystal Ice Mfg. and Cd. Stor Co. (2d Order)	Columbus, O.
**1	32 "	Lafayette Artificial Ice Co.	Lafayette, Ind.
**1	50 "	R. T. McDonald & Judah Hart	New Orleans, La.
**1	12 "	John Hoey (Hollywood Hotel)	Long Branch, N. J.
**1	15 "	Bridgeport Electric and Ice Co.	Bridgeport, Ala.
**1	5 "	Fleischman & Co.	Cincinnati, O.

** These machines were erected in season 1891.

REFRIGERATING MACHINES.

2	50	Ton.	Louisiana Brewing Co.	New Orleans, La.
1	40	"	Toledo Brewing and Malting Co.	Toledo, O.
1	40	"	Hudepohl & Kotte (Brewery)	Cincinnati, O.
1	50	"	Savannah Brewing Co.	Savannah, Ga.
1	25	"	Schantz & Schwind (Brewery)	Dayton, O.
1	15	"	John Smith's Sons (Brewery)	Youngstown, O.
1	12	"	Christ Diehl (Brewery)	Defiance, O.
1	12	"	Genessee Oil Works	Buffalo, N. Y.
1	12	"	S. Davis, Jr., & Co. (Packers)	Cincinnati, O.
1	50	"	Occidental Packing & Provision Co	Lincoln, Neb.
1	15	"	Thos. McFadden, Jr. (Cold Storage	Pittsburgh, Pa.
1	15	"	Grocers' Supply Co. (Cold Storage)	Pittsburgh, Pa.
*1	40	"	Adolph Coors (Golden Brewery)	Golden, Col.
*1	20	"	F. Conrad (Brewery)	Anaheim, Cal.
*1	25	"	The Sachs-Prudens Ale Co.	Dayton, O.

* These machines were erected in 1890.

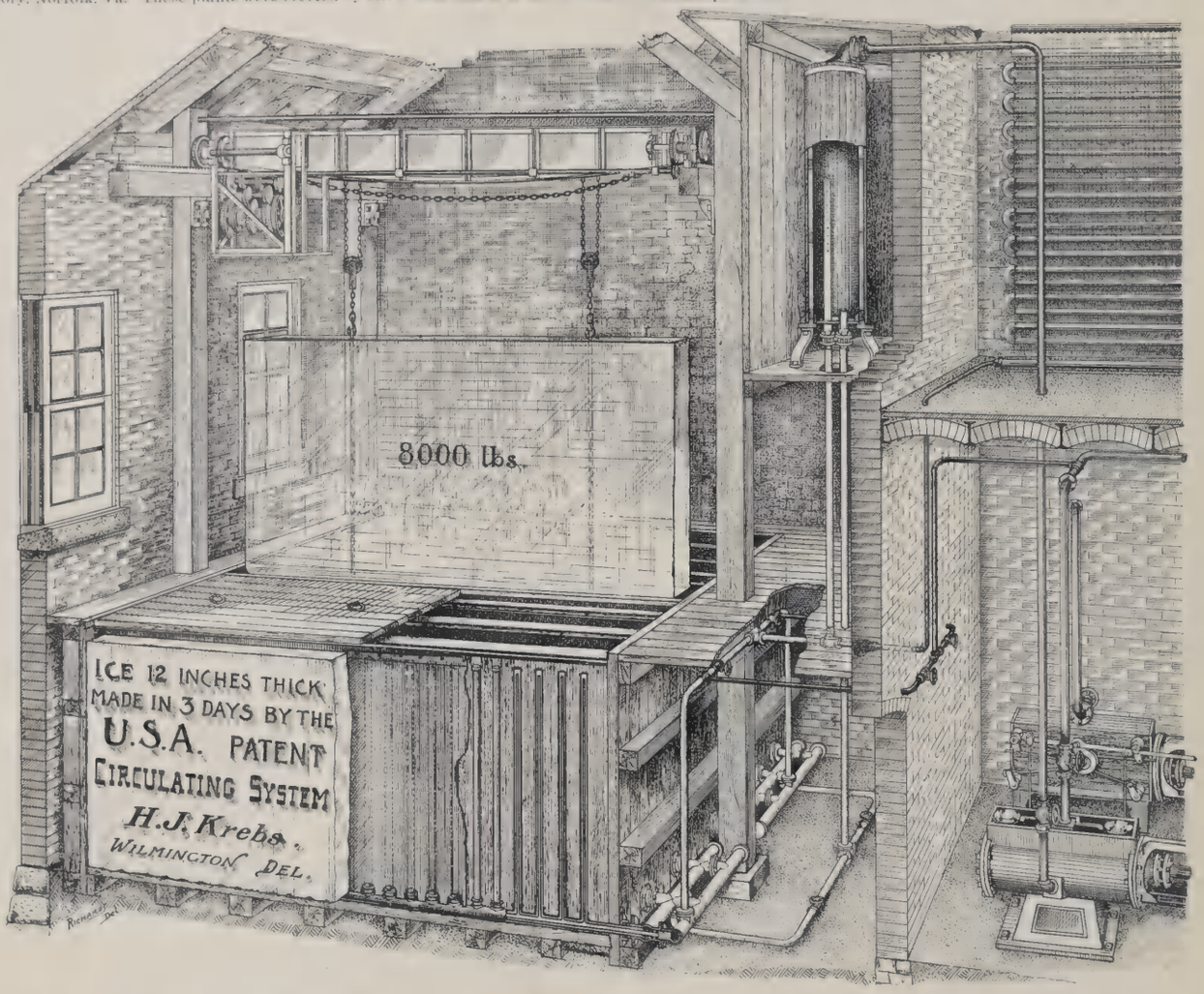
H. J. KREBS' U. S. A. Circulating System of Ammonia

PATENTED SEPTEMBER 9, 1890.

The results achieved by this system, both for brine cooling and ice making, are unexcelled. It ensures dry gas to the pump and abundance of feed to the expansion pipes, therefore economy in piping, economy in ammonia and economy in space. It is simple and easily operated, and saves time, money and worry.

IN ORDERING MACHINES SPECIFY THE U. S. A. CIRCULATING SYSTEM.

During last year it was introduced with great success in the following establishments: Charles W. Street, Packing House, Baltimore, Md.: Washington Abattoir Co., Bennings, D. C.: New Abattoir, Philadelphia Stock Yards, Philadelphia, Pa.: Wilmington Abattoir and Cold Storage Co., Wilmington, Del.: J. S. Bell & Sons, Ice Factory, Norfolk, Va. These plants were erected by Mr. J. C. Mustard, of 1818 N. 17th St., Philadelphia, Pa.



This system is suitable for all makes of Compression Machines. It secures ample feed to the expansion pipes and a regular flow of dry gas to the compressors, which thereby are enabled to do more and better work.

SOME OF THE ADVANTAGES ARE: Reduced number of valves, reduced pipe surface, reduced first cost, reduced consumption of ammonia, reduced attendance, reduced space, reduced wear and tear, reduced bills, increased refrigerating effect, increased certainty of operation, increased life of machinery, increased satisfaction, increased balance sheet. For full particulars address

H. J. KREBS, M. E., WILMINGTON, DEL.

J. C. MUSTARD,

1818 North 17th Street, Philadelphia, Pa.

BUILDER OF

ICE MAKING AND REFRIGERATING MACHINES

DURING LAST YEAR I HAVE ERECTED THE FOLLOWING PLANTS:

∴ REFRIGERATING . MACHINES ∴

N. Autle, Pork Packer,	Washington, D. C.	Big Elk Dairy,	Oxford, Pa.
C. Spuck, Sausage Maker,	Baltimore, Md.	West Chester Dairy,	West Chester, Pa.
David Eichner, Pork Packer,	Baltimore, Md.	Chas. W. Street, Packing House,	Baltimore, Md.
J. F. C. Hansen, Pork Packer,	Baltimore, Md.	Washington Abattoir Co.,	Bennings, D. C.
Jos. J. Martin, Brandywine Dairies,	Cossart, Pa.	Wilmington Abattoir and Cold Storage Co.,	Wilmington, Del.
R. W. Downing, Wallingford Dairy,	Wallingford, Pa.	New Abattoir, Philadelphia Stock Yards,	Philadelphia, Pa.
H. B. & E. A. Pugh, Dairy,	Oxford, Pa.		

∴ ICE . PLANTS ∴

J. S. Bell & Sons, Ice Factory, Norfolk, Va. Suffolk Ice Co., Suffolk, Va.

The last named plant I am now about starting, having changed it from absorption to compression. A number of above plants are fitted with the U. S. A. Circulating System, which for efficiency, economy, and simplicity cannot be surpassed. My long experience in the ice and refrigerating trade enables me to select the best, and I take especial pride in furnishing high grade machinery at moderate cost.

J. C. MUSTARD,

1818 North 17th St., Philadelphia, Pa.

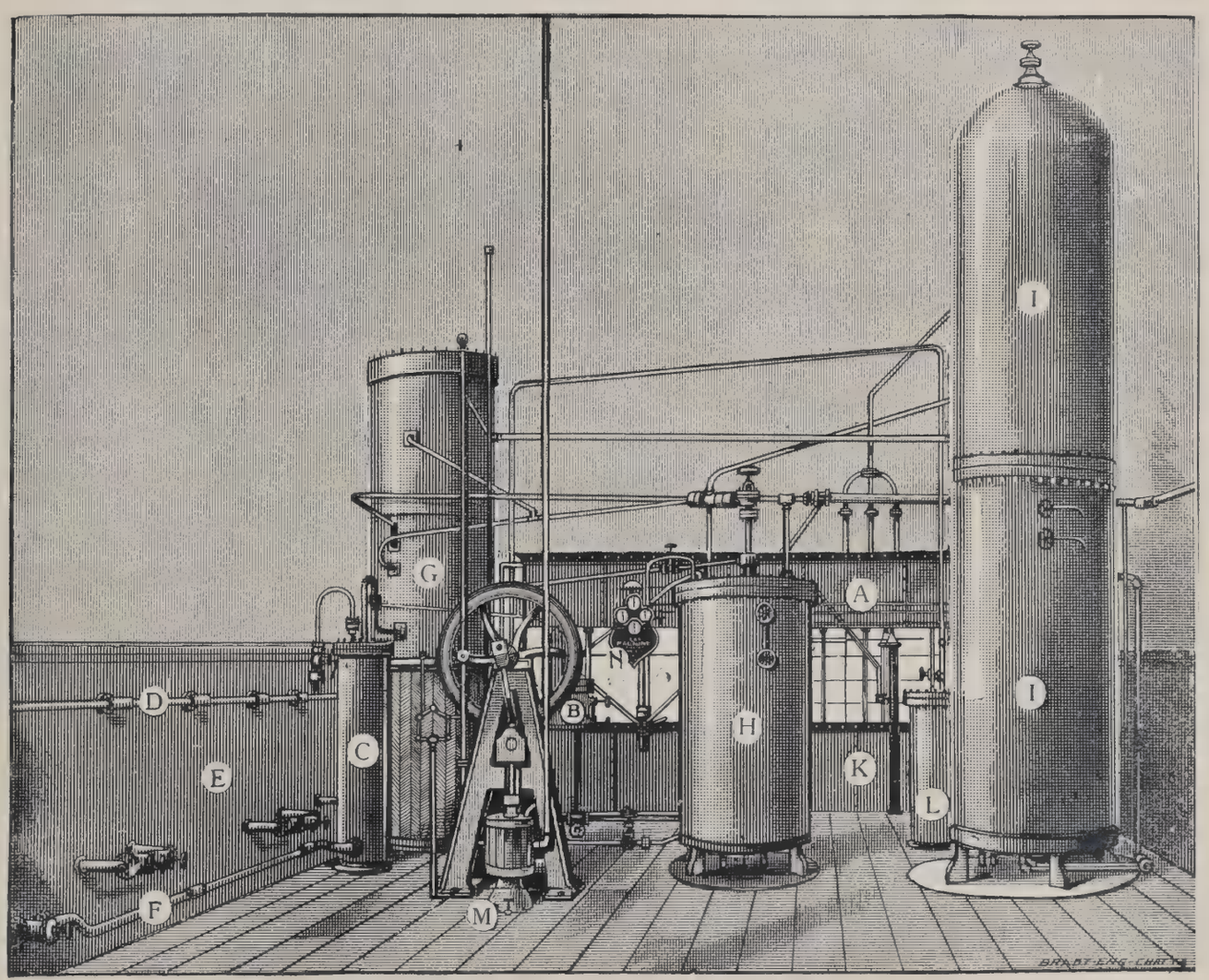
CORRESPONDENCE SOLICITED.

SOUTHERN ICE MACHINE CO.

SOLE OWNERS AND MANUFACTURERS OF

• • • The Latest Improved Absorption • • •

ICE AND REFRIGERATING MACHINE.



∴ THE SOUTHERN ∴

The SOUTHERN ICE AND REFRIGERATING MACHINE is one of the best and has been acknowledged by the most experienced ice manufacturers to work more economical and produce ice cheaper and of a better quality than any other machine on the market to-day.

ALL MACHINES NOW IN OPERATION ARE GIVING PERFECT SATISFACTION.

FOR ESTIMATES AND FURTHER PARTICULARS ADDRESS THE . . . .

SOUTHERN ICE MACHINE CO.

CHATTANOOGA, TENN.

THE DE LA VERGNE REFRIGERATING MACHINE CO.

MANUFACTURERS OF

Foot of East 138th Street (Port Morris.)

NEW YORK, U. S. A.

REFRIGERATING AND ICE MACHINES AND ANHYDROUS AMMONIA . . . .

Over

360

Machines are now in Successful Operation, Representing a Total Capacity Equal to the Melting of over

18.000

Tons of Ice Per day.



Machines are used for the Cooling of

Breweries, Abattoirs and Packing Houses, Markets and Cold Storage, Hotels and Restaurants, Chemical Works, Confectioneries, and Chocolate Manufactories, Steamship Holds, Wineries, Dairies,

AND FOR THE MANUFACTURE OF **ICE**

A FULL DESCRIPTION OF OUR SYSTEM AND APPARATUS WILL BE SENT TO PERSONS APPLYING FOR THE SAME.

CORRESPONDENCE FROM PARTIES DESIROUS OF CONTRACTING FOR PLANS IS SOLICITED.

Estimates and Proposals will be promptly furnished free of charge as soon as the requirements are made known to us.

PICTET

Ice and Refrigerating Machine

....MANUFACTURED BY....

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

WE DO NOT USE AMMONIA.

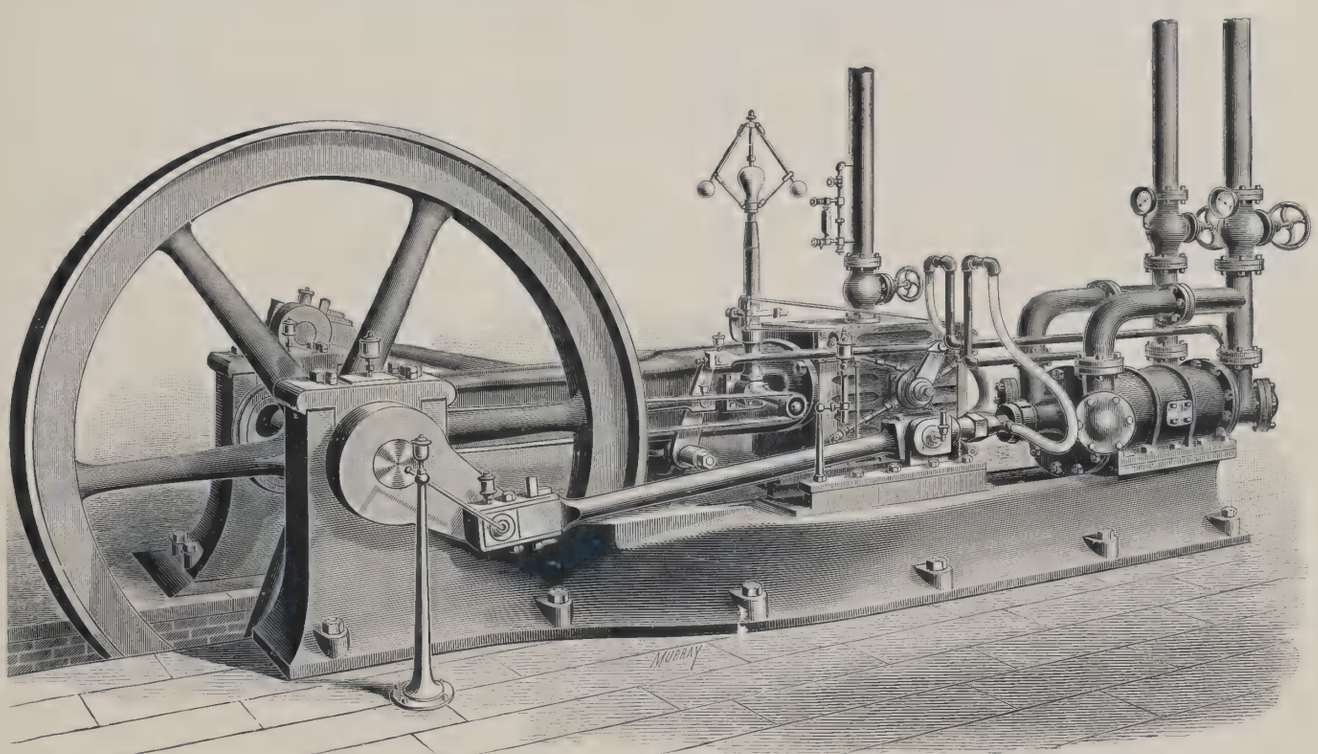
Pictet Machines use **Anhydrous Sulphurous Oxide,** a chemical noted for its low working pressure, is of itself a lubricant, and does not injure any of the metals; its low pressure is a guarantee against explosion.

NEW YORK BOARD OF FIRE UNDERWRITERS,
BUREAU OF SURVEYS
JAMES HARRISON, Supt.
Boreel Building, 115 Broadway, Room 37.

NEW YORK, January 24, 1891.

THE PICTET ARTIFICIAL ICE CO. (Limited), New York:

Dear Sirs: Your favor of the 23d inst. is at hand. In reply, the examination of our expert and his subsequent report were convincing that the article known as Anhydrous Sulphurous Oxide is a safe article for storage or shipment, its tendency being to extinguish rather than to cause fire. Yours truly, JAMES HARRISON, Supt.



Working Pressure from 50 to 75 lbs.

We guarantee GREATER ECONOMY OF FUEL, doing the same amount of work with less coal than any machine in the market.

FOR LIST OF REFERENCES AND FURTHER PARTICULARS, ADDRESS

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

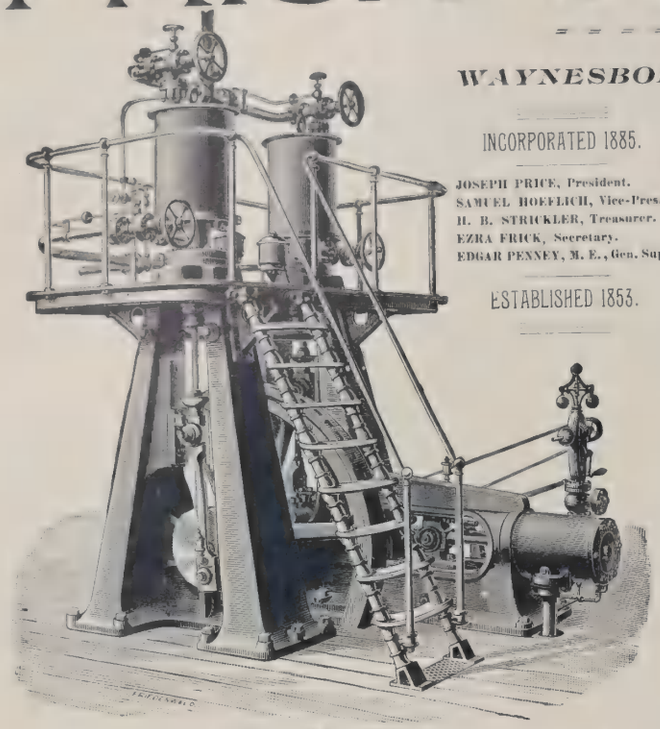
WORKS: NEWBURGH, N. Y.

New York Office, 21 Cortlandt St., Room 6.

FRICK COMPANY

ENGINEERS,

WAYNESBORO, FRANKLIN COUNTY, PA., U. S. A.



5-Ton Machine.

INCORPORATED 1885.

JOSEPH PRICE, President.
SAMUEL HOEFLICH, Vice-Pres.
H. B. STRICKLER, Treasurer.
EZRA FRICK, Secretary.
EDGAR PENNEY, M. E., Gen. Sup.

ESTABLISHED 1853.



MAIN WORKS AND GENERAL OFFICES: WAYNESBORO, PA.

CAPITAL, - - - - - - $1,000,000.

MANUFACTURERS OF THE

ECLIPSE

Ice Making AND Refrigerating Machines.

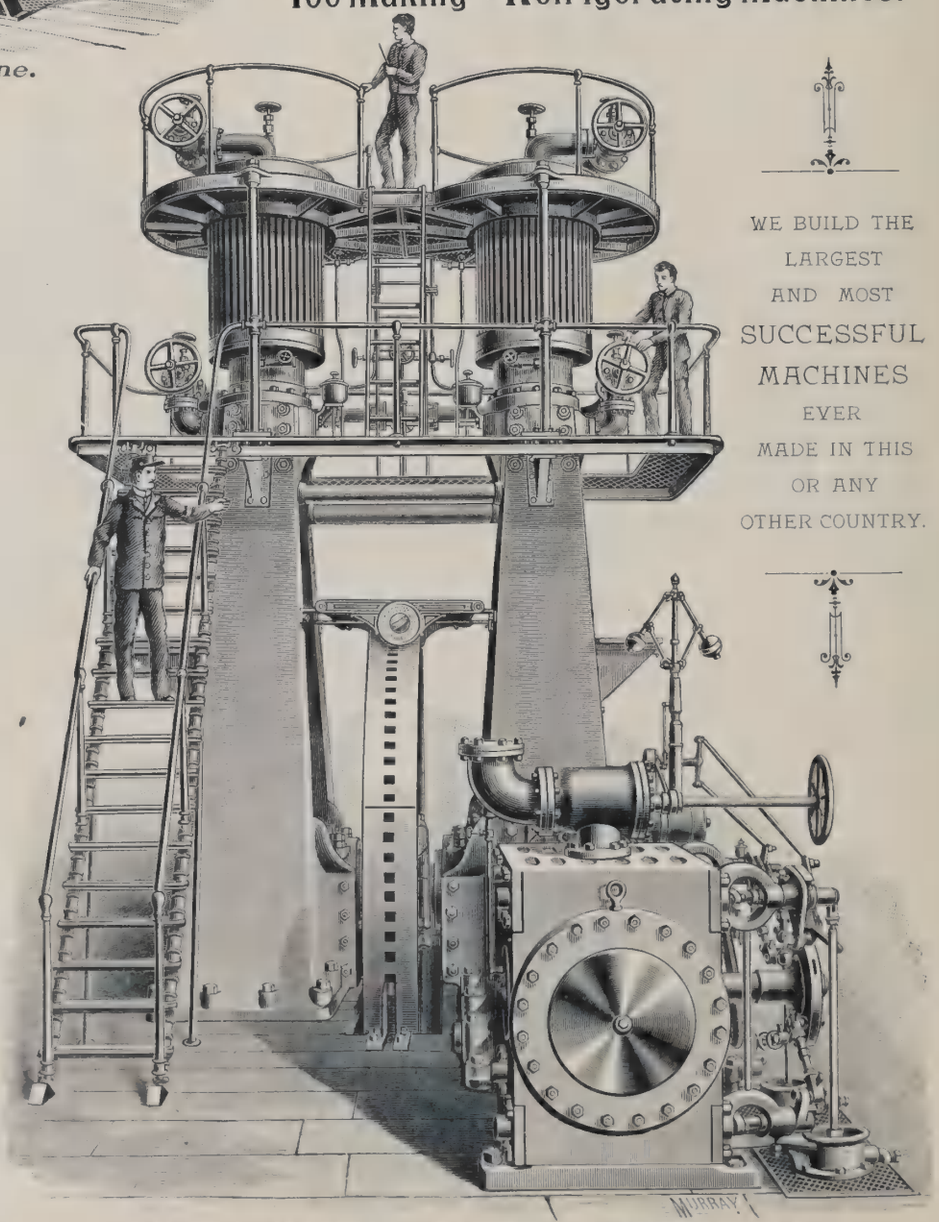
SEND FOR OUR NEW CATALOGUE, 1890.

A Few References:

BREWERIES.	Refrigerating Tons.
Phoenix Brg. Co., Baltimore, Md.	27
Gipps Brg. Co., Peoria, Ill.	50
Sprattler & Mennell, Paterson, N. J.	32
Herman Lackman, Cincinnati.	65
Henry Fink, Harrisburg, Pa.	32
Sebastian Helldorfer, Baltimore, Md.	32
Frank Reisch & Bros., Springfield, Ill.	50
Jos. Stein & Co., Louisville, Ky.	23
Meyer & Reidlin, Covington, Ky.	32
Parkersburg Brg. Co., Parkersburg, W. Va.	27
Bellevue Brg. Co., Cincinnati, O.	50
Cumberland Brg. Co., Cumberland, Md.	27
D. Lutz & Son, Allegheny, Pa.	50
Herman Lackman, Cincinnati (2d order)	80

PACKING AND COLD STORAGE.	
J. C. Shafer & Co., Baltimore	40
G. Cassard & Sons, Baltimore	25
Baltimore City Storage Co., Baltimore	32
Armour Packing Co., Kansas City	100
Shallcross & Son, Coatesville, Pa.	15
Washington Market Co., Washington, D. C.	32
Armour Pckg. Co., Kansas City (2d order)	150
Francis Whittaker & Sons, Wichita, Kas.	150
Emil Winters, Pittsburgh, Pa.	37
Frank Seifrid, Louisville, Ky.	7
Chicago Packing & Provision Co., Chicago	150
Chicago Packing & Provision Co., Chicago (second order)	150
Steelton Store Co., Steelton, Pa.	10
Pittsb'gh Meat Supply Co., Allegheny, Pa.	50
J. Vogle & Son, Cincinnati	50
John C. Hately, Chicago	65
G. H. Hammond & Co., Hammond, Ind.	150
G. H. Hammond & Co., Omaha, Neb	150
Calumet Canning Co., Hammond, Ind.	32
West Chester Cd. Stor. Co., W. Chester, Pa.	40
Chautauqua Lake Ice Co., Pittsburgh, Pa.	20

ICE FACTORIES.	Ice. Tons.
E. L. [illegible] & Co., Hopkinsville, Ky.	10
Consumer Ice Co., New Orleans, La.	100
Little Rock Ice Co., Little Rock, Ark.	35
Owensboro Ice & Cd. Stor. Co., O'sb'o, Ky	20
W. S. Larton, Jacksonville, Ill.	15
Pulaski Ice Co., Pulaski, Tenn.	5
Armour Packing Co., Kansas City	75
Ewing & Beall, Uniontown, Pa.	15
S. W. Hill, Allegheny, Pa.	18
Chautauqua Lake Ice Co., Pittsburgh	40
Chautauqua Lake Ice Co., Pittsburgh (2d order)	40
West Chester Ice Co., West Chester, Pa.	15
Steelton Store Co., Steelton, Pa.	2
Parkersburg Brg. Co., Parkersburg, W. Va.	3
Cumberland Brg. Co., Cumberland, Md.	8
Hagerstown Ice Co., Hagerstown, Md.	20
Alberto Malo, City of Mexico, Mex.	25
Germantown Ice Co., Germantown, Pa.	20
Bryn Mawr Hotel Co., Bryn Mawr, Pa.	20
Geo. S. Sexton & Co., Wytheville, Va.	5
Cambridge Ice Co., Cambridge, Md.	10

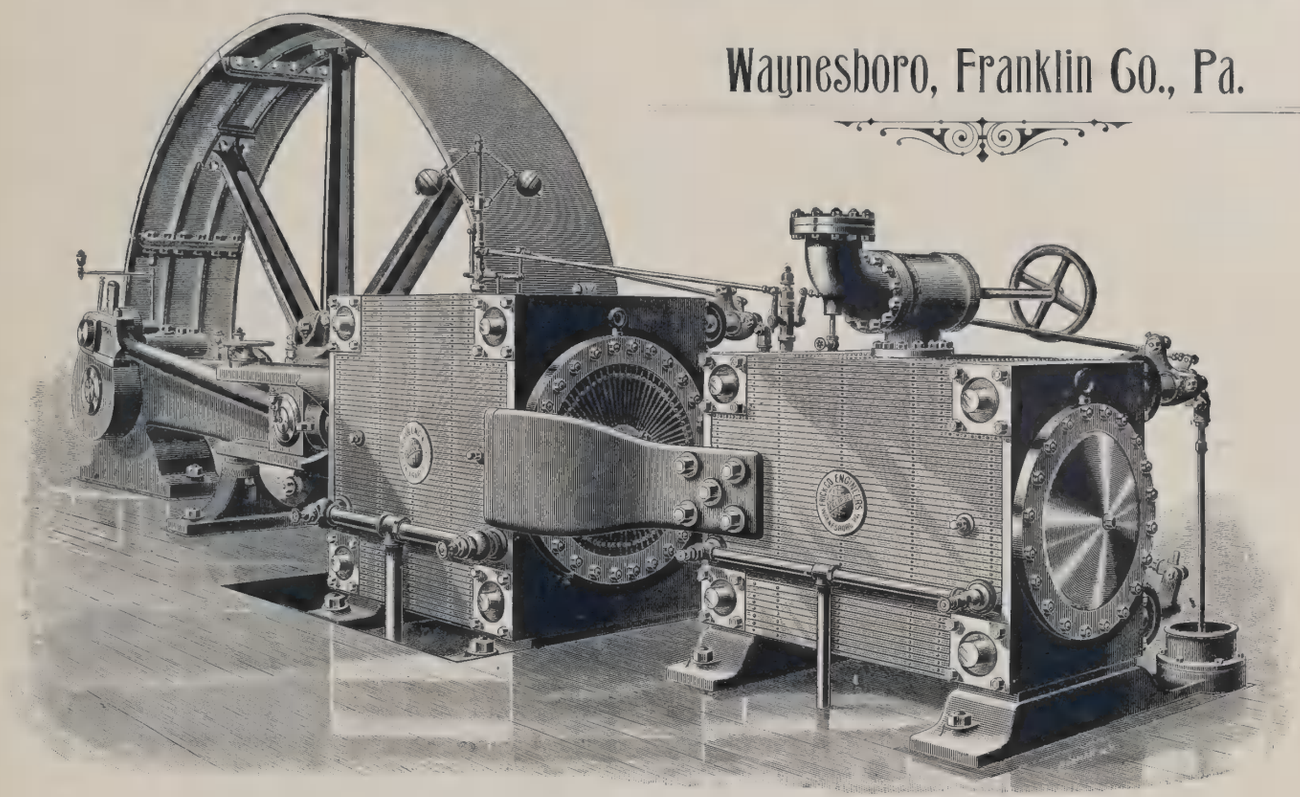


150-Ton Machine. Weight, 193,250 Pounds.

WE BUILD THE LARGEST AND MOST SUCCESSFUL MACHINES EVER MADE IN THIS OR ANY OTHER COUNTRY.

FRICK COMPANY, ENGINEERS,

Waynesboro, Franklin Co., Pa.



A GENUINE CORLISS ENGINE WITH ALL THE LATEST IMPROVEMENTS.

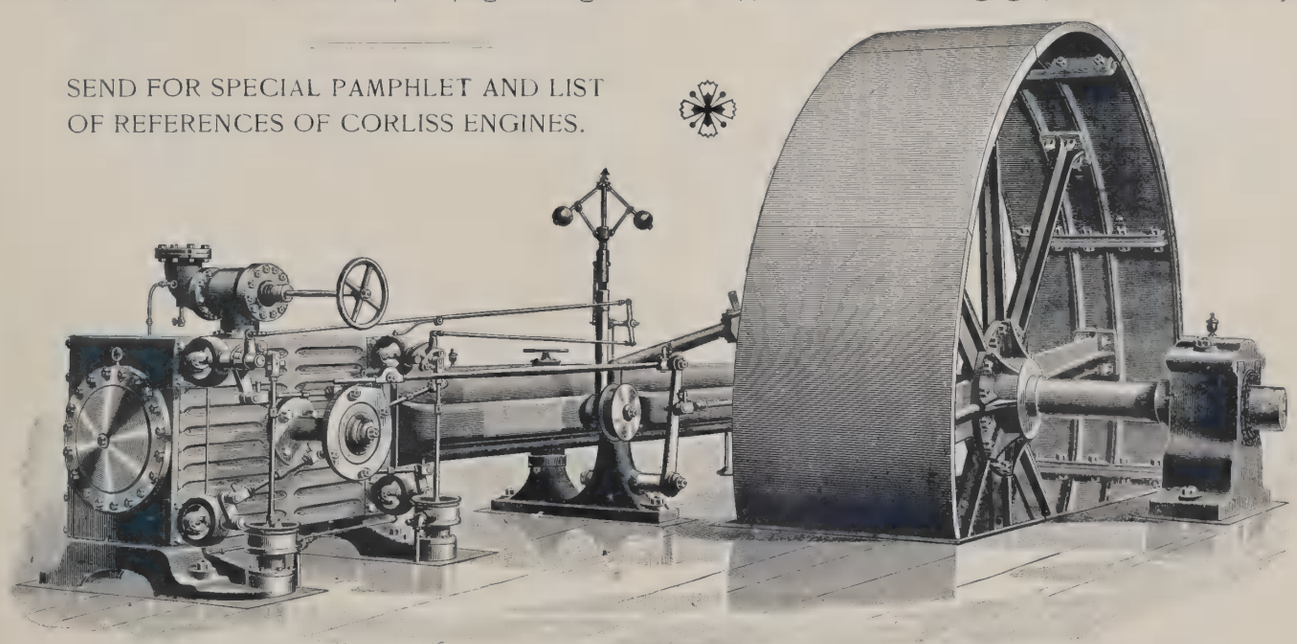
"EGLIPSE" CORLISS TANDEM COMPOUND CONDENSING ENGINE

UP TO 3000 HORSE POWER

We have complete line of patterns and build Corliss Horizontal Stationary Engines, Corliss Vertical Engines, Condensing or Non-Condensing, Single or in Pairs. Corliss Compound Engines, Tandem or Cross Compound. Corliss Engines for any service, 40 to 3000 horse power, in a single engine.

SPECIAL NOTICE.—With our Corliss Engine we contract for fitting up complete the entire Steam Plants, including Steam Boiler, Feed Water Heater, Feed Pumps, Piping, Shafting, and all the appurtenances and belongings peculiar to a first-class job.

SEND FOR SPECIAL PAMPHLET AND LIST OF REFERENCES OF CORLISS ENGINES.



1000 HORSE POWER "EGLIPSE" PLAIN CORLISS ENGINE.

THE WILSON-SNYDER MFG. CO.

MANUFACTURERS OF AUGUST SNYDER'S PATENT

Ice and Refrigerating Machine

SPECIALLY DESIGNED TO MEET THE DEMANDS OF ICE MAKERS AND REFRIGERATION IN ALL ITS APPLICATIONS . . . . . .



INTERIOR VIEW OF WORKS OF THE WILSON-SNYDER MFG. CO.

TWO styles of these machines are built: One, single acting compressor, with duplex condensers and brine tanks; the other, duplex compressor, condensers and brine tanks. The special advantages of this machine over all others are as follows: In either the single or duplex machine, either one of the brine tanks or condensers getting out of order, or anything happening to necessitate repair, the system of valves is so arranged as to allow using but one condenser or one brine tank, and the machine is kept running with the disabled part as though nothing had happened, while the disabled brine tank or condenser is being dismantled and repaired. Write for list of machines in operation, references, prices, etc. . . . . .

ALSO MANUFACTURERS OF IMPROVED . . . .

PUMPING MACHINERY

Including AIR PUMPS, BRINE PUMPS, HOT AND COLD WATER PUMPS, BOILER FEED PUMPS, TANK PUMPS, Etc.

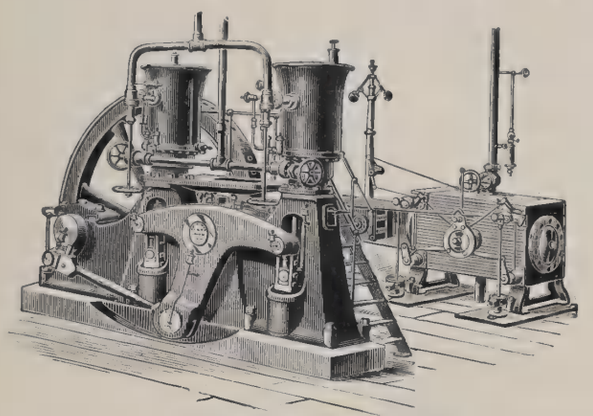
Ammonia Valves, Pipe Coils and Pipe Fittings

. . . . . OF EVERY DESCRIPTION . . . . .

PITTSBURGH, PA.

THE HERCULES ICE MAKING AND REFRIGERATING MACHINE

(REFRIGERANT: ANHYDROUS AMMONIA.)



THE HERCULES ICE MACHINE.

FOR BREWERIES, PACKING HOUSES, COLD STORAGE AND ICE MAKING.



HERCULES WORKS, AURORA, ILL.

The Hercules Ice Machine is the most compact, most economical, most easily handled, well constructed, and thoroughly satisfactory machine in the market.

OUR GUARANTEE IS THE HIGHEST GIVEN BY ANY COMPANY, AND EVERY MACHINE SOLD HAS EXCEEDED THE GUARANTEE.



THE HERCULES MODEL ICE PLANT.

A. NUNNING BREWING CO.

ST. JOSEPH, MO.

HERCULES IRON WORKS, October 13, 1891.
CHICAGO, ILL.

In reply to your inquiry relating to the 40-ton Refrigerator placed by you in our brewery, I am pleased to say the machine has more than met our expectations, and your guarantee fully demonstrating its worth and reliability. It has the past year ran continuously night and day, and has not occasioned any stop for repairs of any kind, and we are greatly pleased to add our name to the long list of testimonials which the Hercules bears. Yours respectfully,

AUG. NUNNING, President.

MEADERS & OSGOOD,

NASHVILLE, TENN.

HERCULES IRON WORKS, July 29, 1891.
CHICAGO, ILL.

Our 25-ton Ice Machine purchased of you, after one month continuous operation has given such complete satisfaction that we do not wish a test of its abilities to perform the work guaranteed. It is now making with ease twenty-five tons daily of the finest ice we have ever seen, besides refrigerating our storage ice house. Congratulating you upon its good work, and wishing you the success you deserve, we are, sirs, Yours respectfully,

MEADERS & OSGOOD.

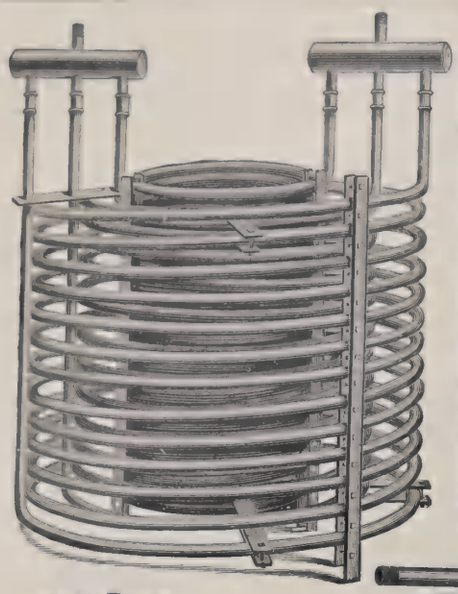
THE HERCULES BLUE BOOK No. 1, FULL OF HELPFUL AND INTERESTING INFORMATION, IS NOW IN PRESS, AND WILL BE SENT FREE TO INTENDING PURCHASERS.

NEW YORK OFFICE, 150 BROADWAY.

THE HERCULES IRON WORKS,

WORKS, AURORA, ILL.

Room 502 Owings Building, Dearborn and Adams Sts., CHICAGO.



JAMES D. CARDELL. WASHINGTON HOPKINS.

JAS. D. CARDELL & CO.

Pipe Bending Works.



RISING SUN LANE & NORTH PENN R. R.

PHILADELPHIA, PA.

MANUFACTURERS OF

IRON, BRASS AND COPPER COILS,

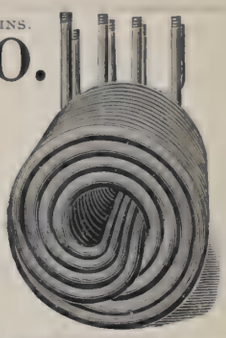
FOR ICE AND REFRIGERATING MACHINES,

CHEMICAL WORKS, SOAP FACTORIES,

FEED-WATER HEATERS, ETC.

COILS OF ANY DESIRED WELDED LENGTH

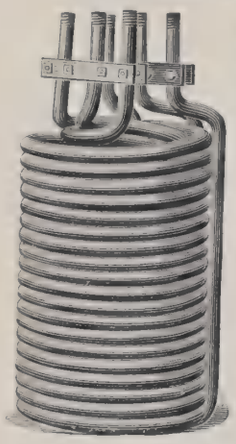
CATALOGUE AND PRICES ON APPLICATION.



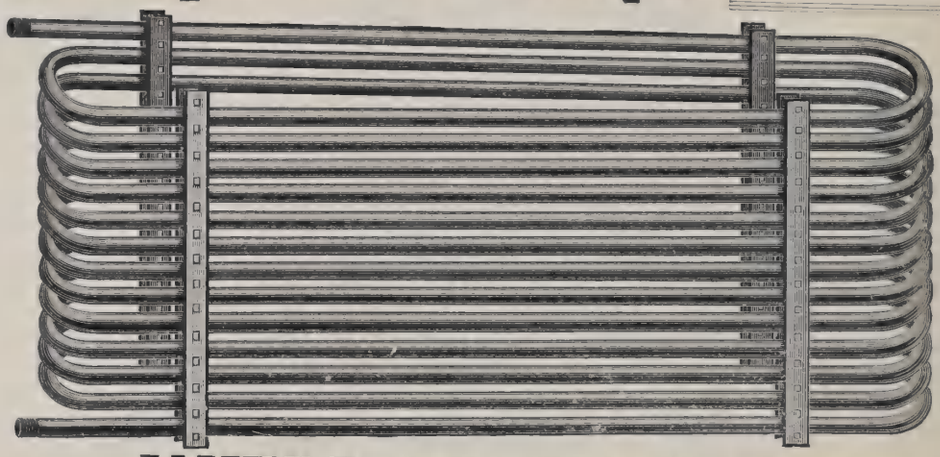
BENDING @

Of Large Sizes Pipe a specialty

SEND FOR CATALOGUE.



Brine and Condenser Tanks, Ammonia Bottles, Ammonia Valves, Flanges, ETC.



JAMES D. CARDELL & CO.

PIPE WELDING BY ELECTRICITY



THE SAMPSON STEAM FORGE Co

OFFICE AND WORKS, CORNER Sacramento and Carroll Aves.,

CHICAGO.

MANUFACTURERS OF

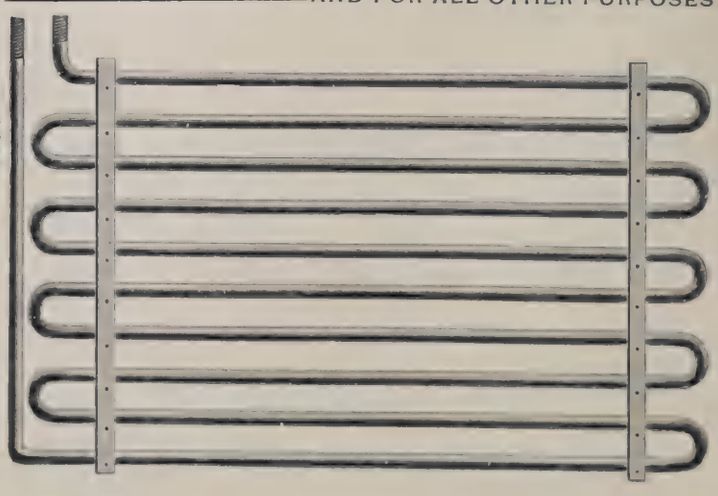
WROUGHT IRON COILS

FOR ICE AND REFRIGERATING MACHINES . . . .

AND FOR ALL OTHER PURPOSES

These Coils are tested under water with 500 lbs. pressure, to guard against leaks. A steel ball is passed through each coil to show that its area has not been reduced in bending and welding, and if a leak is discovered the piece is cut out and a new one welded in by electricity. A weld made by electricity never leaks. PRICES ON APPLICATION.





Write for Prices on the . . . . . .

CORRUGATED... ... WATER-TUBE **FEED-WATER HEATER**

More Effective and Durable . . . . . .
Than a Coil Heater at the Same Price.

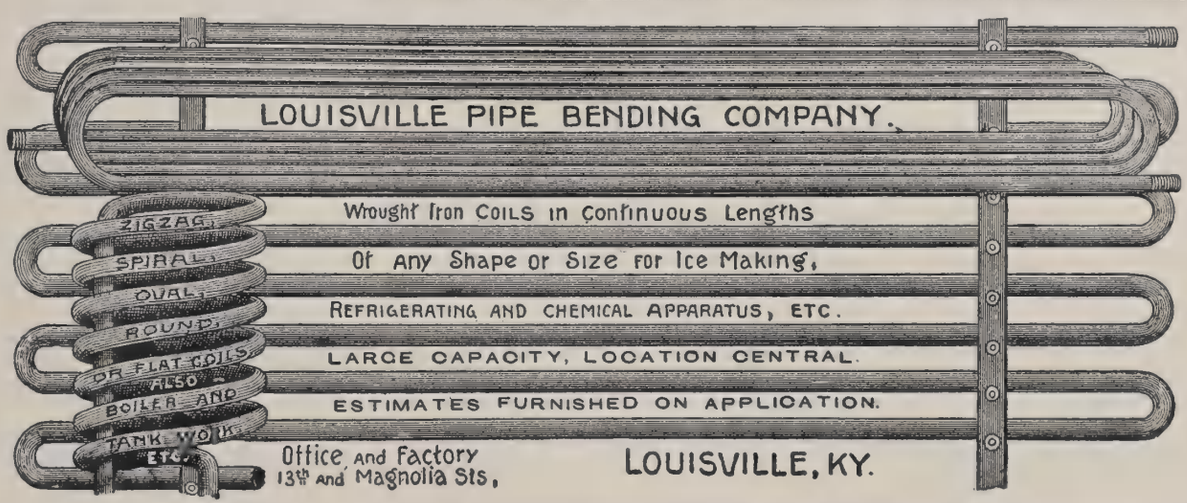
SOLE MANUFACTURERS:

The Wainwright Manufacturing Co. of Mass.

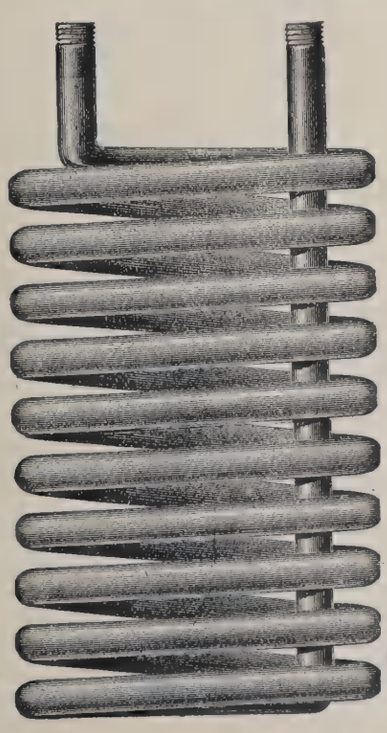
8 Oliver Street, BOSTON.

SEND FOR CATALOGUE I. C.

CHICAGO: 26 West Randolph Street.
NEW YORK: 121 Liberty Street.



THE HARRISBURG PIPE BENDING CO. LIMITED.



WORKS, S. E. CORNER HERR STREET AND PENNSYLVANIA CANAL. HARRISBURG, PA.

.....MANUFACTURERS OF.....

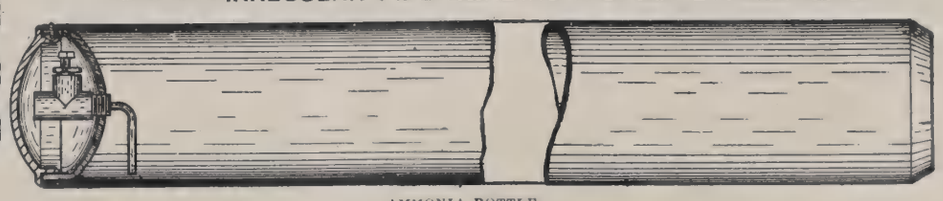
COILS AND BENDS

Of Wrought Iron Pipe . . For Ice Making and Refrigerating

in Round, Oval, Zigzag, Spiral, Helical and Tapering Forms.

CHEMICAL WORKS, FEED-WATER HEATERS,
BLAST FURNACES, EVAPORATING LIQUIDS,
AMMONIA MACHINES, SOAP WORKS, ETC.

IRREGULAR PIPE BENDING A SPECIALTY



AMMONIA BOTTLE.

AMMONIA . BOTTLES . OR . FLASKS . WITH . WELDED . HEADS

STRAIGHT OR CONCAVE

New York Coal Tar Chemical Co.

10 WARREN ST., NEW YORK.

MANUFACTURERS OF

ABSOLUTELY PURE

ANHYDROUS AMMONIA

AND

AQUA AMMONIA

FOR REFRIGERATING PURPOSES.

THE ELECTRIC PIPE BENDING COMPANY

OF

HARRISON, N. J.

ARE NOW PREPARED TO FILL ORDERS FOR

SPIRAL COILS,
ZIG-ZAGS, OVALS,
IRREGULAR SHAPES
OF ANY SIZE AND LENGTH

The work is done by the THOMSON ELECTRIC WELDING AND HEATING PROCESSES, thus giving greatly superior results to any of the old methods.

No injury from over-heating. Welds and Bends as sound as the rest of the pipe. All work promptly executed and guaranteed.

NO BURNT OR
DEFECTIVE WELDS.
NO SCALE.

ADDRESS ELECTRIC PIPE BENDING COMPANY,
HARRISON, N. J.

The National Ammonia Co.

... ABSOLUTELY DRY AND PURE ...

LIQUID ANHYDROUS AMMONIA AND AQUA AMMONIA (ALL STRENGTHS),

For Refrigerating and Ice Machines.

GENERAL OFFICES:--ST. LOUIS, MO.

Our Ammonias are the Recognized Standards of Quality. Use Our Brands and Secure the Best Results with your Machines.

We are the Largest Manufacturers in the World. Send your Orders to Us and Get Prompt and Satisfactory Service.

Our Ammonia can be had of the following Agents:

NEW YORK—The De La Vergne Refrig. M. Co. : W. M. Schwenker. : Mallinckrodt Chemical Works. : PHILADELPHIA—Theo. J. Goldschmid. : BALTIMORE—Wm. Mitchell. : WILMINGTON—Delaware Chemical Co. : BUFFALO—Kast Copper & Sheet Iron Co. : ST. LOUIS—Mallinckrodt Chemical Works. : Larkin & Scheffer. : CINCINNATI—Herman Goepper & Co. : CLEVELAND—Benton, Myers & Co. : DETROIT—Michigan Ammonia Works. : KANSAS CITY—Henry Menderson. : CHICAGO—A. Magnus' Sons. : Fuller & Fuller Company. : MILWAUKEE—The Chas. Baumbach Company. : SAN FRANCISCO—Herrmann & Company. : PORTLAND, ORE.—Snell, Heitschu & Woodard.

B. P. CLAPP AMMONIA COMPANY,

MANUFACTURERS OF

ABSOLUTELY PURE - - 26° AQUA AMMONIA

Containing 29¼ per cent of Ammonia. FOR REFRIGERATING PURPOSES AND THE TRADE . . . . . .

GENERAL OFFICES:

245 BROADWAY, NEW YORK.

THE CLEVELAND ANHYDROUS AMMONIA WORKS

THOS. FLESHER, JR., Proprietor.

MANUFACTURERS OF ...PURE... Anhydrous Ammonia.

70 E. Prospect St., CLEVELAND, OHIO.

WM. B. SEVERN. A. L. CAVEN.

SEVERN & CAVEN,

MANUFACTURERS OF

ABSOLUTELY PURE ..... Liquid Anhydrous Ammonia

MANUFACTURED FROM SULPHATE OF AMMONIA ONLY.

WORKS: WHITE HILL, N. J.

OFFICE: 48 N. Delaware Ave., PHILADELPHIA.



GEO. WOOLFORD,

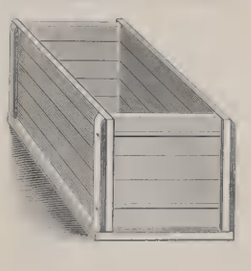
Manufacturer of all kinds of

Cedar Vats, Tanks, HOT & COLD Water Tanks, Railroad Tanks

In sending for estimates, state if measurements are inside or outside, and thickness of wood desired . . . . . .

FOR ICE FACTORIES, COLD STORAGE HOUSES RAILROADS, PACKERS, CHEMICAL WORKS, ETC.

2240, 2242 and 2244 North 9th Street, PHILADELPHIA.



THE LAIDLAW & DUNN CO.

PURCHASERS OF { McGOWAN PUMP CO. / ECLIPSE PUMP MFG. CO.

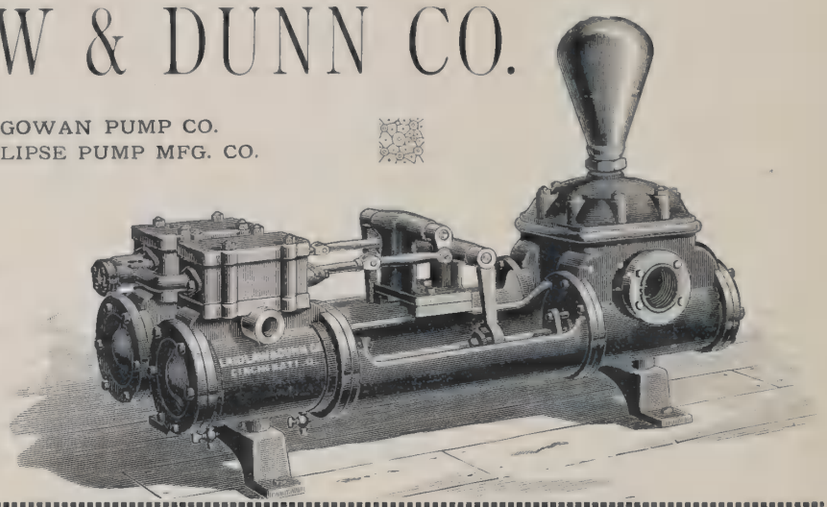
MANUFACTURERS OF

BRINE
WATER
BREWERY

PUMPS

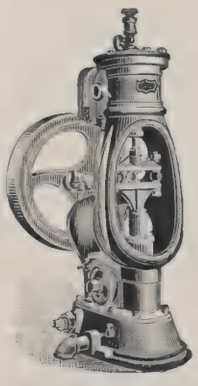
AND PUMPS FOR ALL PURPOSES.

CINCINNATI, OHIO.



AMMONIAL LIQUID . . . .

PUMPS



FOR USE IN.....

ICE MAKING AND REFRIGERATING PLANTS

These Pumps are made very heavy and guaranteed to work smoothly against 300 pounds pressure to the square inch . . . . . .

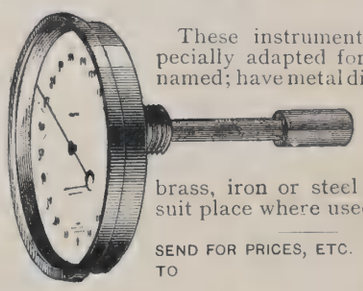
VALLEY PUMP CO.

EASTHAMPTON, MASS.

Standard Thermometers.

FOR USE IN

Ice Machines,
Refrigerators,
Brine Tanks,
Ammonia
Circulating Pipes,
Etc., Etc.



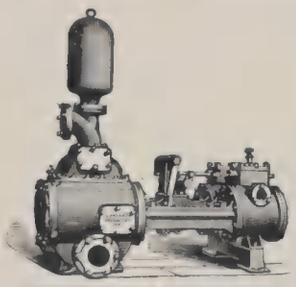
These instruments are especially adapted for purposes named; have metal dials, either brass, iron or steel casing to suit place where used.

SEND FOR PRICES, ETC. TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Cortlandt St. Boston Office, 70 Pearl St.



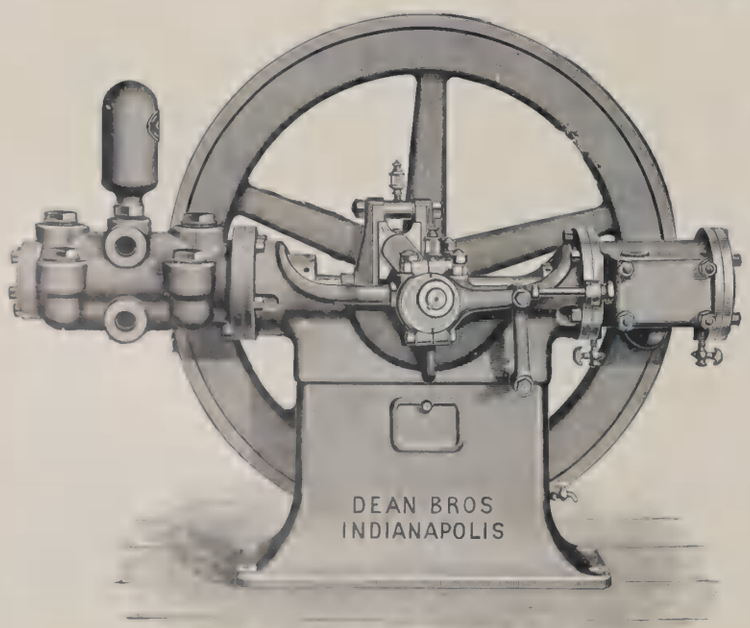
DUPLEX WATER SUPPLY PUMP.

DEAN BROS.

· Steam Pump Works ·

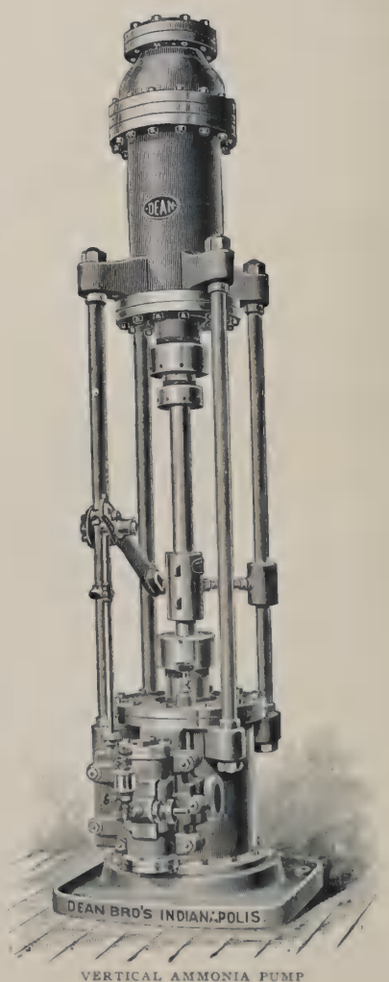
INDIANAPOLIS, IND.

BOILER FEEDERS, BRINE PUMPS,
DEEP WELL PUMPS, SINGLE AND DUPLEX PUMPS.



HORIZONTAL AMMONIA PUMP.

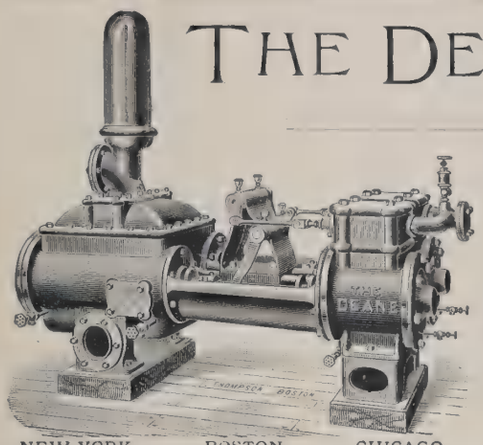
SEND FOR CATALOGUE



VERTICAL AMMONIA PUMP

THE DEANE STEAM PUMP CO.

HOLYOKE, MASS.



STEAM PUMPS

FOR EVERY SERVICE.

AMMONIA PUMPS,
BRINE PUMPS,
TANK PUMPS, ETC.

For Ice Manufacturing Machinery

For full information and Illustrated Catalogue, write . . . . . .

NEW YORK BOSTON CHICAGO.
PHILADELPHIA. ST. LOUIS. DENVER.

DEANE STEAM PUMP CO., Holyoke, Mass.

A. D. COOK

.....MANUFACTURER OF IMPROVED.....



Tube Well Supplies

Cook's Patent Tube Well Strainers

AND

STEAM PUMPS ...A... SPECIALTY

LAWRENCEBURG, IND.

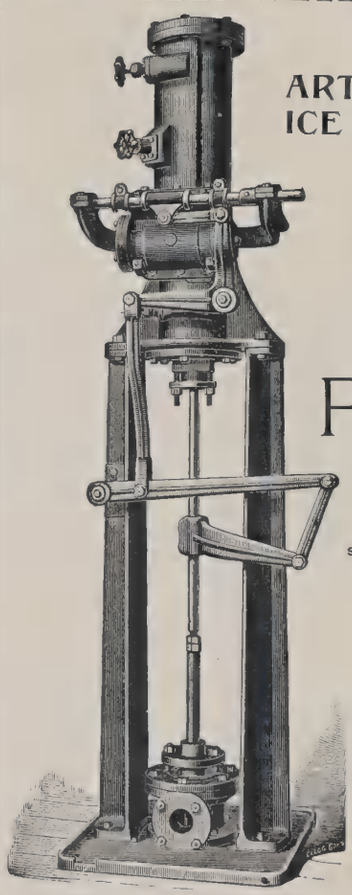
EPPING Pump

. . . DEEP-WELL

....FOR....

ARTIFICIAL ICE COMPANIES

BREWERIES
COLD STORAGE
WAREHOUSES



PUMPS

For all Purposes.

SEND FOR CATALOGUE TO

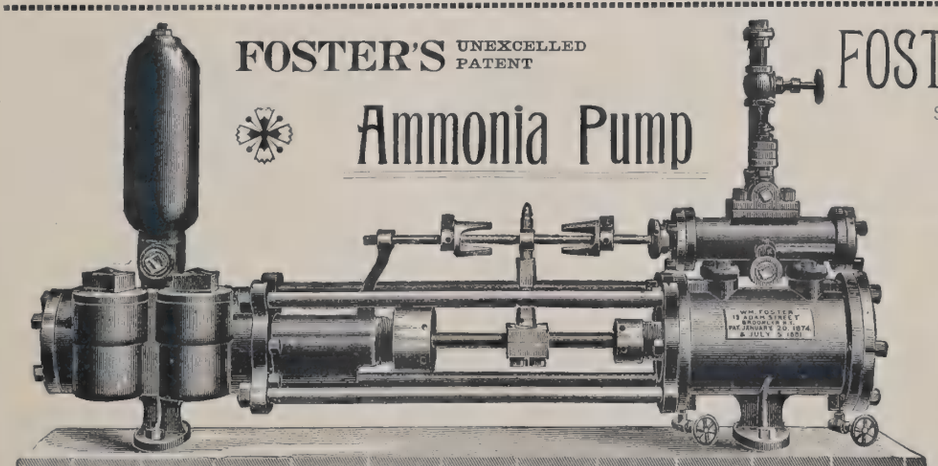
EPPING, CARPENTER & CO. LIMITED,

2410-2420 Penn Ave.,

PITTSBURGH, PA.

FOSTER'S UNEXCELLED PATENT

Ammonia Pump



FOSTER PUMP WORKS

Successors to WILLIAM FOSTER

MANUFACTURERS OF

PATENT IMPROVED

STEAM PUMPS

FOSTER'S EXCELSIOR ROTARY PUMPS,

Beer and Mash, Boiler Feed, Tank, Air, Deep Well and Artesian Well Pumps.

36 AND 38 BRIDGE ST. BROOKLYN, N.Y.

The advantages of this Pump are, its extra long double stuffing-box, which is so arranged that any leakage from first stuffing-box is carried back into the suction again. It has extra hard steel Piston Rod, which is made in two sections, so as to be easily replaced when ammonia part of piston rod is worn out, and without necessitating the removal of the steam portion of rod.

HERF & FRERICHS CHEMICAL CO.

ST. LOUIS, MO.

MANUFACTURERS OF

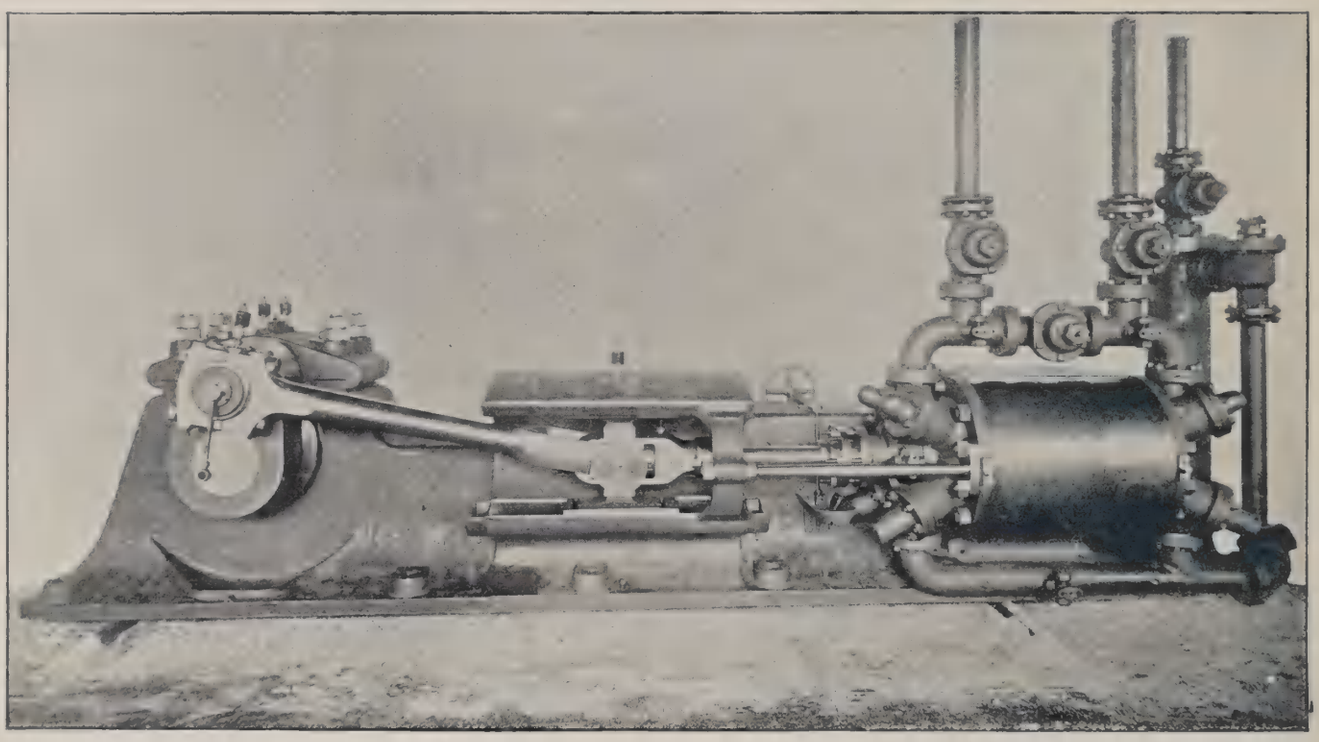
Liquid Anhydrous Ammonia

ABSOLUTELY DRY, PURE AND UNIFORM ALL THE YEAR ROUND . . . . .

26° Ammonia

SPECIALLY PURIFIED FOR ABSORPTION . MACHINES . . . .

All our Ammonia is made from Sulphate Ammonia only. Large capacity, best qualities and quick shipments.



No. 8 LINDE COMPRESSOR

100 TONS CAPACITY.

MANUFACTURED BY

THE FRED. W. WOLF CO.

560 North Halsted Street, CHICAGO, ILL., U. S. A.

FOR ICE FACTORIES, COLD STORAGE HOUSES, BREWERIES AND PACKING HOUSES . . . . .

CORRESPONDENCE SOLICITED. . .

OVER 1300 MACHINES IN ACTUAL OPERATION.

ICE AND REFRIGERATION

ILLUSTRATED

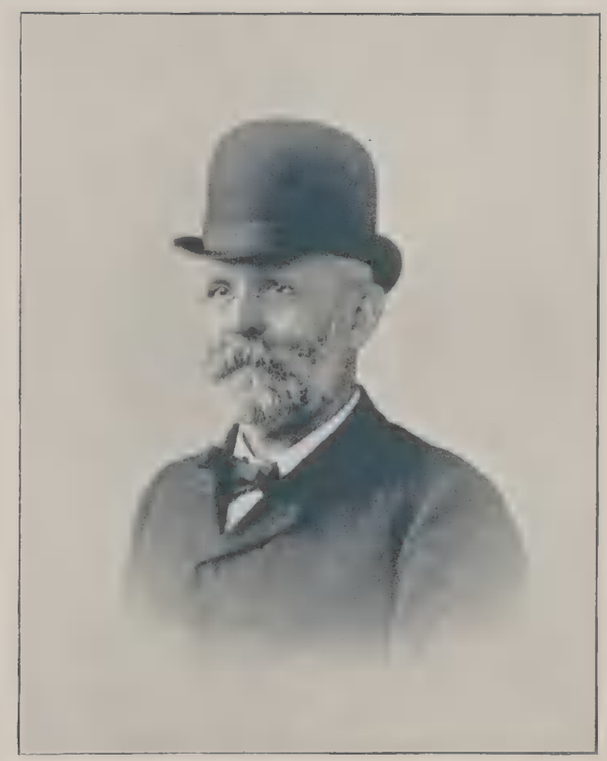
A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. I. NO. 5. CHICAGO : NEW YORK : NOVEMBER : 1891. $2.00 PER ANNUM.

ICE MAKING IN WILMINGTON, DEL.

PEN AND PENCIL SKETCHES OF THE DIAMOND ICE CO.'S MODEL ESTABLISHMENT—DETAILS OF THE PLANT—HISTORY OF THE COMPANY.

The ice making establishment of the Diamond Ice Co., Wilmington, Del., is in many respects deserving of special notice and comment in our columns. The writer was recently granted the opportunity and every facility for a thorough inspection of the establishment, while in operation. He was not only deeply impressed with the thoroughness of the system pervading every department and detail of the work, but also with the economy displayed in harvesting and handling the product, and the remarkable clearness and purity of the ice. We have endeavored to illustrate this latter fact by presenting the portraits of Messrs. Warner and Dorr, as seen through fourteen inches of solid ice. These are *fac simile* reproductions of original photographs.



E. T. WARNER, WILMINGTON, DEL.

The factory is worked upon what is generally known as the plate system, with some very important modifications. The ammonia is expanded through continuous coils 1,200 feet in length, from the liquid anhydrous, at a pressure of 180 pounds, to a gas at a pressure of ten pounds. The gas is compressed with ordinary compressors, carried through the condenser, liquefied, and again passes through the freezing coils as above described. No salt or brine is used, and the coils make $\frac{1}{16}$ of a ton per day ordinarily, with a freezing surface of 280 square feet, the temperature of the ammonia in the freezing coils being generally 6° to 8° below zero.

Water is kept in circulation constantly, being discharged by the vats at the bottom, running out at the top, and passing through filters on its return to the tanks. This constant filtration and sucking of the water through the filters brings it in contact with a partial vacuum, and deprives it of a large percentage of air that is natural to water, which is one reason why the ice is perfectly clear. We believe this process is a new one, and that this is the only factory in the United States making ice in this way without brine.

THE ENGINES AND COMPRESSORS.

The compressors are two in number. The smallest, which is used in conjunction with larger on same system, is of the vertical type, is compound condensing, 16-inch diameter of high pressure cylinder and 30-inch diameter of low pressure cylinder, and 16-inch stroke, having jet condenser. Both high and low steam cylinders are surmounted by compound ammonia cylinders, whose pistons are 9×15½ inches respectively, and might be termed trunk pistons. The ammonia and steam pistons are secured to same rods, and between cylinders are suitable stuffing boxes for each. This compressor runs up to eighty-five revolutions on occasion, and turns out about twenty-five tons of ice per day. Average speed this season has been about seventy revolutions, and twenty tons of ice product.

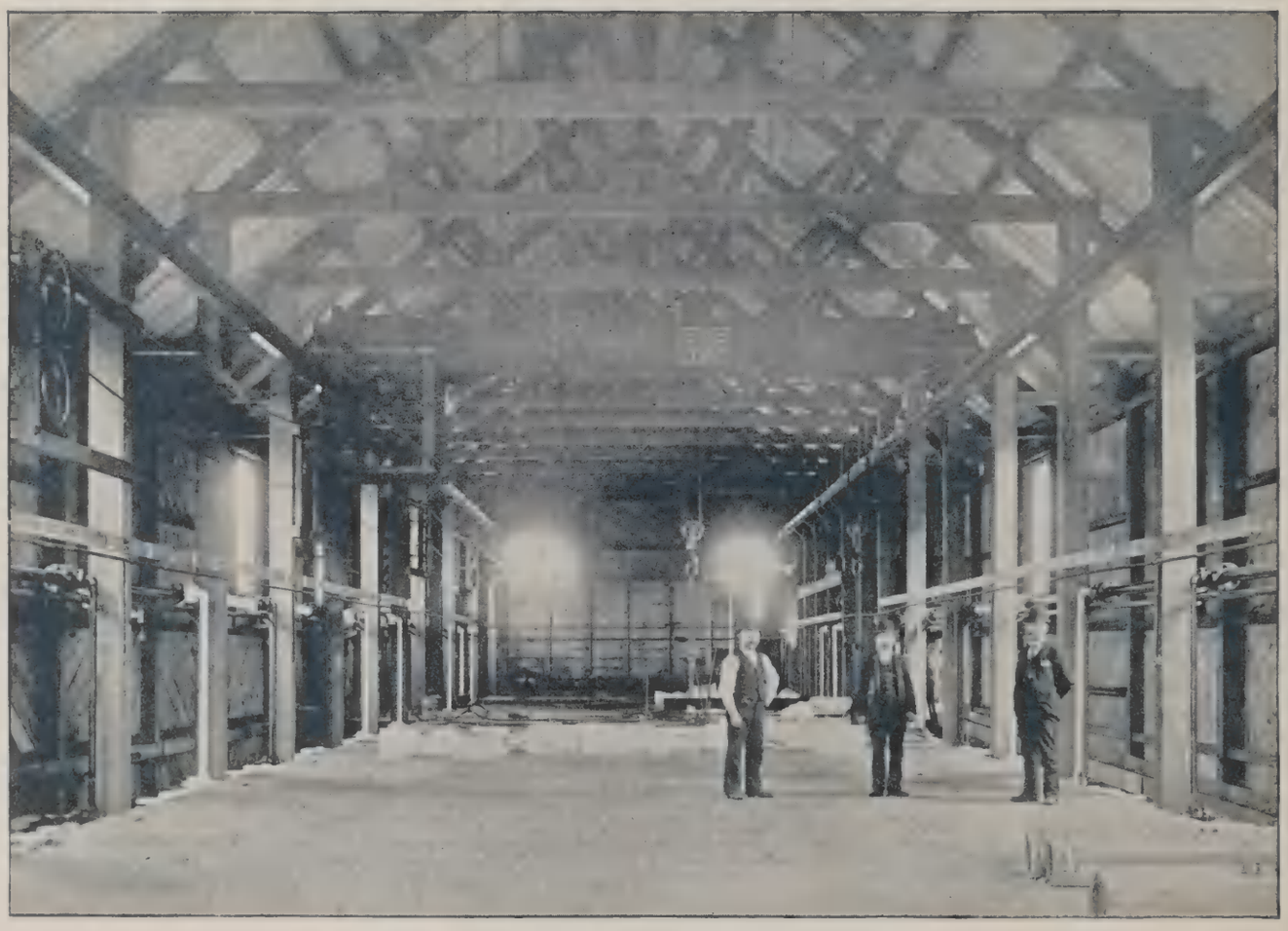
The horizontal compressor has engine of Corliss type, high pressure cylinder 16-inch diameter, and low pressure cylinder 30-inch diameter and 36-inch stroke. The high and low drive on to cranks on each end of crank shaft, and the two double-acting ammonia cylinders, which are also worked compound, are placed tandem to the steam cylinders; the 17-inch initial or low pressure being behind 30-inch steam cylinder, and the 11-inch delivery on high pressure being behind 16-inch steam cylinder. The return ammonia gas is drawn into 17-inch cylinder, and delivered through 100 feet of 3-inch pipe in form of a worm coil, which is submerged in running water, into 11-inch cylinder at about seventy-five pounds pressure, from

which it goes to atmospheric condenser on roof, which is of the Buffalo Refrigerating Machine Co. pattern, of Buffalo, N. Y., and contains 8,000 feet of 1½-inch pipe, divided into ten sections. The water for surface and ammonia condensers is drawn from the Brandywine creek by rotary pumps, the maximum temperature of water being 85° in warm weather. This compressor at sixty revolutions has a capacity of fifty-five tons, and at the usual speed of forty-seven has made forty-five tons this summer.

Edson's ammonia pressure recording gauges are used for both back and condensing pressures, and are considered invaluable. Steam recording gauges are also used, which has insured an even and economical operation of plant in connection with damper regulators.

tory lot is 400×170 feet, and besides tank house, engine and boiler house, offices and stables, has ice storage houses for 1,200 tons. The loading platforms have spaces for eighteen wagons to load at same time, and ice runs to all parts on iron tracks requiring very little handling; washing platforms are also provided, and wagons are washed twice and sometimes three times a week.

From May 1 to September 1 this company have manufactured nearly 10,000 tons of ice. Daily measurements of ice in tanks is made, and increase computed on printed forms for the purpose, and a monthly tabulated statement kept with the daily reports on file. In this way all of the system is kept up to its highest efficiency. System is pursued in everything as far as practicable, and it is found that employes are rather inclined to prefer it



INTERIOR VIEW OF FREEZING ROOM, DIAMOND ICE CO., WILMINGTON, DEL.

In this connection we show diagram, which is a *fac simile* of the records made by both engines and compressors on August 26 last—an average showing.

BOILERS, PUMPS, ETC.

The boilers, two horizontal tubulars of 100-horse power each, furnish steam for all purposes, besides compressors: a small 20-horse power vertical engine, which drives rotary pumps, power pumps for feeding boilers and those for circulation of water in tanks, and also steam for ice cutters. The consumption of coal is claimed to be about ten pounds per 100 pounds of ice made. Coal is brought to the wharf, near boiler house, in barges, and does not entail further handling after unloading.

DELIVERY FACILITIES.

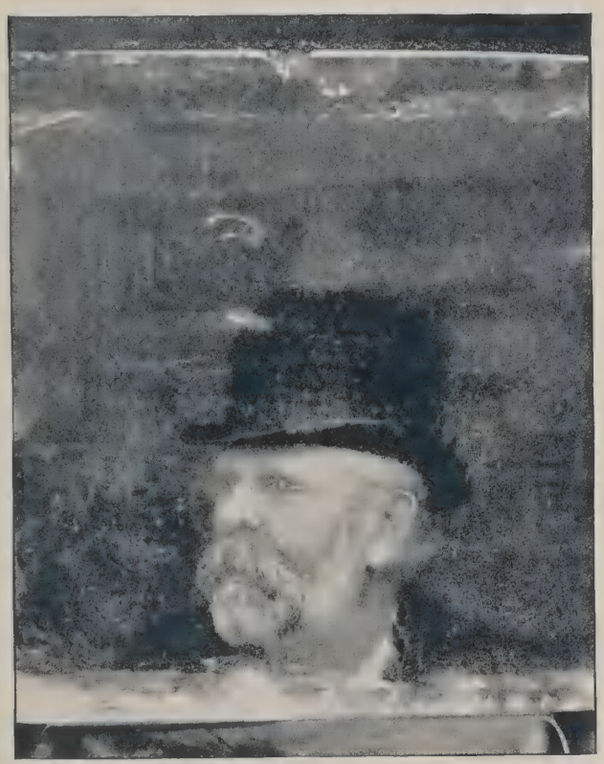
The teams number nineteen double and one single, and stable contains forty-one head of horses. The factory to the hap-hazard style, which so often causes friction between the hands.

THE FREEZING SYSTEM.

The house is 180 feet long and forty-seven feet wide, built of wood, double sheathed on sides, with felt paper between courses, is about thirty feet to peak of roof, which is slate.

The tanks are built on stone foundations, and are twenty-nine feet long, inside measurement, and eleven feet deep. Those having eight freezing cells are eleven feet three inches wide, while those having six freezing cells are seven feet ten inches wide. All timber used in construction of tanks is of the best yellow pine, and is put together ship fashion, *i. e.*, seams are reamed, caulked with oakum, and leaded, then their sides given a good coat of pitch. The plan pursued in the con-

struction of tanks was to make each of the twelve separate and distinct from its neighbor, so that if by any possibility a leak should occur it would not occasion a loss of water except in the tank it occurred in. To accomplish this it was of course necessary to carry the bulkheads (10×10 Y. P. bolted together) below the floor of tanks and through ends. This arrangement has been found to be very satisfactory, and as the posts which carry the overhead track for crane rest upon tank foundations, they were placed on center lines of bulkheads, and bolted to them, making a very strong construction.



E. T. WARNER, THROUGH FOURTEEN INCHES OF ICE.



A. L. DORR, THROUGH FOURTEEN INCHES OF ICE.

Water for ice is secured from city service, and is put through a 48-inch Jewell improved filter, made by the O. H. Jewell Filter Co., 73 and 75 W. Jackson St., Chicago, from which it goes into a fore-cooling tank 25×8×10 feet deep, above the top of tanks. This water is about 35° when run into freezing tanks, and is cooled by return gas, which passes through it in a coil of 5-inch pipe 300 feet long, lengths joined by cast iron return bends, and joints made with gum rings, as are all ammonia joints in use.

The circulation of water in process of freezing is carried on continuously in all tanks, overflowing at one end into an insulated box through which it runs across ends of tanks, and pitches toward large tank on lower floor, where it is drawn away by a power pump through two Jewell filters, and then returned to freezing tanks, being delivered at bottom at opposite end from where it overflows. The initial filter is washed out twice every twenty-four hours, and the other two three times, or once each eight hours. Each filter has a capacity of 50,000 gallons per hour. The plates or cells are what may be called dry, being direct expansion, and no brine used at all. Each cell, of which there are eighty-eight in all, contains 255 feet of 1¼-inch pipe, and are connected by fours, *i. e.*, 1,000 feet of expansion coil to each feed cock. The coil surface presented is 9×13 feet, while the plates (¼-inch thick) which

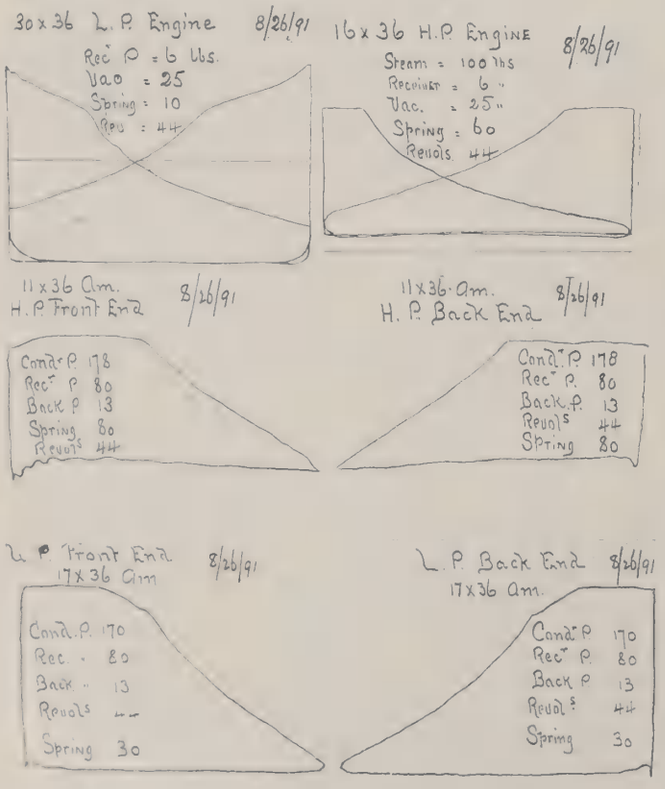


LOADING PLATFORM DIAMOND ICE CO.'S WORKS, WILMINGTON, DEL.

cover them are 10×14 feet; the spaces between pipes is filled in with wood, the whole secured together by bolts.

The harvesting is done at night. After the ice is loosened from the plates, by hot gas passed through the coils in the cells, it is hoisted out by an 8-ton crane built by Wm. Sellers & Co., Ltd., Philadelphia, power being furnished it by rope running the length of building. The ice blocks are carried to tables raised to a nearly vertical position by an ingenious mechanism, and lowered on to shelf upon table. The crane is cut loose, and table brought to horizontal, when the large 10×14 ice cake, weighing sometimes as high as 8,000 pounds, according to thickness, is cut up into blocks 22×22 inches with steam cutter, which cuts through the whole depth, giving blocks of uniform size, and with square edges, a great advantage when storing in house or cars, also in wagons, as the jarring of the ice by fitting closely together, and loss from melting are reduced to a minimum, it being harder for air currents to get through. On double days the harvest is frequently as high as 120 tons in eight hours, employing four men and a boy to run crane, besides foreman of gang; four men in ice house when storing is done completes the force.

The steam ice cutter used is the invention of Mr. Lea Pusey, president of the company. It is simply an arrangement of fine copper pipes passing steam through them in sufficient quantities to be condensed, the discharge from them being only water in small quantities.



ENGINE AND COMPRESSOR CARDS, DIAMOND ICE FACTORY.

This apparatus, of which patent is applied for, is competent to cut up four tons of ice in twelve minutes.

HISTORICAL.

The manufacture of ice in Wilmington was commenced in 1886 by Mr. Lea Pusey. The system pursued was the cooling of brine and the pumping it through cast iron plates with passages in them. Six plates were used, and an output of about four tons per day obtained. The next year six more cells were added, bringing the output to eight tons per day. The small compressor had but one 9×15½-inch cylinder. In 1888

DIAMOND ICE COMPANY.

ICE REPORT.

4 P. M. Saturday July 11th 1891

A	1	3	16	E	25	9½	5 1	H	49	3	1 6	K	73	12	6 5
	3	3	16		27	9	4 9		51	4	2 1		75	12	6 5
	5	3	16		29	10	5 4		53	4	2 1		77	12	6 5
	2	5	2 7		31	10	5 4		55	3	1 6		79	12	6 5
	4	3½	1 9		26	9	4 9		50	4	2 1		74	11½	6 2
	6	4	2 1		28	9½	5 1		52	4	2 1		76	12	6 5
	Total		11 5		30	9½	5 1		54	3½	1 9		78	12	6 5
	Pre.		5		32	10	5 4		56	3½	1 9		80	11½	6 2
	Inc.		11 0		Total		41 3		Total		15 4		Total		51 1
B	7	Out Friday			Pre.		37 1		Pre.		1 9		Pre.		44 6
	9				Inc.		4 2		Inc.		13 5		Inc.		3 5
	11		44 0	F	33	7½	4 0	I	57			L	81	11	5 9
	8				35	9	4 9		59				83	10	5 4
	10				37	8	4 3		61	10½			85	10	5 7
	12				39	8½	4 6		63				87	9½	5 1
	Total	Out Friday			34	8½	4 6		58				82	10½	5 7
	Pre.				36	8½	4 6		60				84	11	5 9
	Inc.				38	8	4 3		62	Out			86	10	5 7
C	13				40	7½	4 0		64				88	9½	5 1
12½	15	Out Friday			Total		35 3		Total				Total		44 5
11½	17		42½		Pre.		28 6		Pre.				Pre.		39 5
10	14				Inc.		6 7		Inc.				Inc.		5 0
8½	16			G	41	6½	3 5	J	65	13	7 0	SUMMARY.			
7½	18				43	5½	3 0		67	12½	6 7	Total.	21	20	5
50	Total	Out Friday	42½		45	5	2 7		69	12½	6 7	In Tanks.	13	13	9 4
20	Pre.				47	4½	2 4		71	12½	6 7	Amount.		339	9
	Inc.				42	6	3 2		66	13	7 0	Out to-day.		8	6 6
D	19	11½	6 2		44	6	3 2		68	13½	7 3	Last acct.		4	26 5
	21	12½	6 5		46	5½	2 7		70	13½	7 3	Taken.		36	1 6
	23	13½	7 0		Total		23 9		Total		55 7	Total.			
	20	13½	7 0		Pre.		14 7		Pre.		52 0	Increase.		64	9
	22	12½	6 7		Inc.		9 2		Inc		3 7				
	24	13½	7 3												
	Total		40 7												
	Pre.		38 7												
	Inc.		2 0												

SAMPLE DAILY REPORT, DIAMOND ICE CO.

another cylinder was added, engine compounded and fourteen more freezing plates added, making twenty-six in all. In the fall of 1889 the Diamond Ice Co. was incorporated, and at once set about improving and increasing the capacity of plant, and an output of thirty-five tons in 1890 was obtained. During the fall of 1890 and spring of 1891 the plant was placed in its present complete condition, with an output of sixty tons per day.

The Diamond Ice Co. consists of Messrs. Lea Pusey, president; E. T. Warner, vice-president and manager; A. D. Warner, secretary and treasurer.

BIOGRAPHICAL.

The success attending the efforts of the Diamond Ice Co. in constructing and operating a model ice factory is in a large degree due to the ability and practical skill of Mr. A. L. Dorr, the general superintendent of the works.

This gentleman has had much experience of a practical and scientific nature with ice making and refrigeration generally. He was for four years, ending in 1878, connected with the motive power department of the B. & A. R. R. at Boston, then in charge of A. B. Underhill, superintendent. Upon leaving Boston he accepted a position as draughtsman and constructing engineer with the Ingersoll Rock Drill Co. He then spent two years in Chicago with the M. C. Bullock Manufacturing Co., and one year with Crane Bros. as superintendent of outside construction. He was then recalled to New York by the Ingersoll Rock Drill Co., where he remained until the spring of 1887, when he was sent to Danville,

Va., to take charge of Smith plate system plant. In the spring of 1889 the Diamond Ice Co. offered him his present position. In 1890 and 1891 the present direct expansion system was erected for this company under his direction.

Mr. Dorr is a thorough master of the business of ice making, and enjoys the confidence of his employers to the fullest extent. He is very methodical and systematic in his work, and this accounts for the very practical system of records and daily reports which he has introduced in this factory. A *fac simile* illustration of one of these daily reports is shown in this connection.

ELECTRIC PIPE BENDING.

Every operator of an ice making or refrigerating plant understands the value of perfect piping, with few joints and no leaks; for leaks of ammonia gas are not only detrimental to health, but destructive of the product in ice, or the contents of the cooling room, as well as expensive in renewing wasted charges. The production of pipes and coils is, therefore, a most interesting process in connection with refrigeration, and in order to see it at its best, the writer recently made a visit to the works of the Sampson Steam Forge Co., Chicago, where the manufacture of bends and coils for ice and refrigerating plants is made a specialty. The process begins with the pipe as received in straight lengths, 1¼-inch diameter, which are first balled, using a 1⅛-inch steel ball, which is run through the pipe in order to ascertain the condition of the unseen interior of the pipe. The balling, of course, instantly discloses any defects, such as interior scale or projections or imperfect diameters. Should these appear, stopping the movement of the ball, they are remedied by forcing the ball through; or, should this be impossible, the length is rejected. The pipe, having been balled, is then sent to the forge and heated for bending, which is done on a machine, which looks simple enough, but is, in fact, the result of the experience of many months of trial, and consists of a simple system of wheel-like jaws and levers as the mechanical forces, which are guided by the eye and the hand of the expert, who, with them, molds the pipe into any forms required. The bent pipe is then again balled to test the diameter of the bend, and, if it proves true, it is ready for welding; if not, the defect is remedied or the piece rejected.

The most interesting step of the process is the welding of short lengths to make one continuous pipe of any required length, which is done by this company by the electric process. The machinery consists of an engine and 60-horse power dynamo, and the welder. The latter occupies a floor space of about 2½×4 feet, the visible parts being simply two sets of triangular jaws to hold the pipe ends, and a series of insulated wires conveying the current of electricity. The pipes, cold, are placed in the jaws, end to end, and the current of electricity turned on. Soon the ends begin to heat to a red, then to a yellow—almost to that point of melting where the metal begins to run. They slowly creep together, and in less time than it takes to tell it, the weld is finished, the process consuming probably less than a minute, and so perfect is the union that, while the joint itself is visible, the actual point of junction is absolutely indistinguishable, the two pieces of pipe having in fact become one, as completely as if originally so made. The pipe is then again balled, for though failure by this process to weld to a perfect diameter is extremely rare, it may occur, and the test is invariably made. Then follows the test for possible leaks. This test is made by air pressure. The pipes are immersed in a bath of clear water, and connected with a double-cylinder air compressor, which compresses atmospheric air to 600 pounds per square inch. Under this pressure (which is about two-and-a-half times the pressure of ammonia gas, as carried by refrigerating pipes), should there be any defect in the pipes (as frequently does appear), it is detected by the fine air bubbles which come up through the water to the surface. Every foot of pipe is critically examined, and wherever the bubbles appear, showing even the most minute leak, that part of the pipe is marked for rejection. It is cut out, a new piece welded in, and the air test repeated until no further leak can be detected. Then, and not till then, the coil is marked "O. K.," and is ready to ship.

It will thus be seen that the system insures absolute perfection in piping; and, on this account, the above company have been awarded the contract for 800 coils for the Chicago Cold Storage Exchange plant, which plant is to cost $2,000,000 when completed.

NEW BOOKS.

"KEY TO STEAM ENGINEERING." A thorough and exhaustive catechism of the steam engine and boiler. By W. R. B., M. E. Also the Combustion of Coal Chemically and Practically Considered. By H. S W. Boston: 1891. The Mason Regulator Co., 10 Central street. Price, 30c.

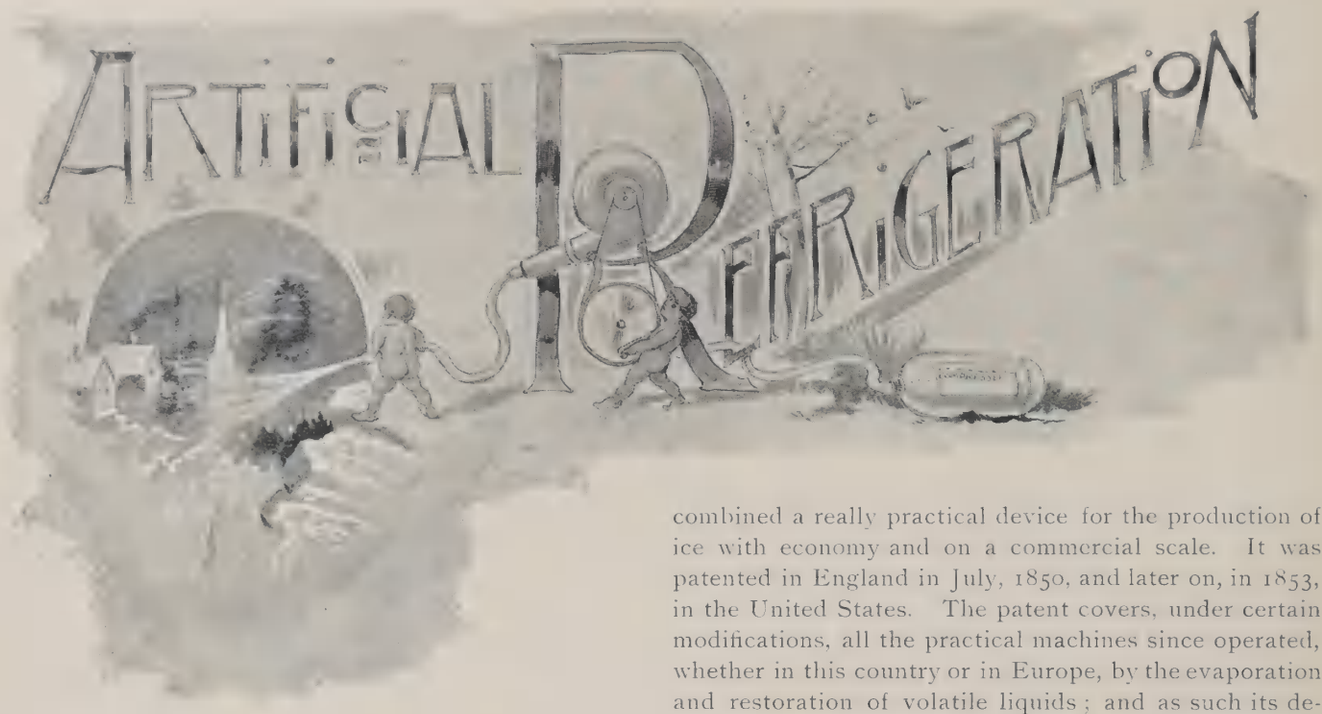
This is the second edition of this little work (just the size for a coat pocket), into which, in the form of questions and answers, is compressed the information contained in half a dozen volumes, which, however learned and valuable, fail of their purpose—the education of the engineer—because their information is conveyed in technical and algebraic terms. In this little work the information is clothed in plain, every-day English, avoiding tables, terms, etc., not readily understood. For the uses of the engine room is almost invaluable, being complete, as well as accurate, and based on the best and latest authorities. It is handsomely printed and bound, and should be in the hands of every steam engineer.

"COMMON SENSE IN MAKING AND USING STEAM." For the consideration of proprietors of steam plants. By "One Who has Paid for His Experience." Boston: 1891. The Mason Regulator Co. Price, 25c.

This volume of sixty pages, by Wm. H. Bailey, M. E., of Rochester, N. Y., is designed for the information of proprietors of steam plants; and its suggestions cover the entire subject, the topics discussed being as follows: How to select an engine and boiler; its location; arrangement of parts; boilers; furnaces and fuel; feed water and apparatus; boiler compounds, skimmers and automatic attachments; engines; lubricants and lubricators; engineers and firemen; contracts and guarantees; convenient rules, tables and facts; brief items of information; and embraces a very ample index. The writer's experience covers some thirty years in every capacity, from fireman to contracting engineer and owner. His style is terse and clear, and his ideas cannot fail to benefit those whom he addresses, as he discussed just the facts every owner wishes to understand.

"THE HERCULES BLUE BOOK, NO. 1." A Catalogue. Chicago and Aurora: 1891. The Hercules Iron Works.

This is the new catalogue of ice making and refrigerating machinery made by the above company. It contains not only a large number of handsome illustrations of their machinery, and full information regarding them, but also a large amount of matter relating to refrigeration in general, in all its applications, which is not only interesting, but valuable and very suggestive of new applications by owners.



[*Written for* ICE AND REFRIGERATION.]

ARTIFICIAL REFRIGERATION.

A CHRONOLOGICAL STUDY OF ITS DEVELOPMENT—THE ICE MAKING MACHINES OF JACOB PERKINS, OF PROF. TWINNING AND OTHERS.

BY AUGUSTE J. ROSSI, B. S., C. E.

[*Continued from October issue, page 192.*]

Having thus described the different principles on which artificial refrigeration is based, and examined the first attempts made to apply the simplest of them, we will proceed now to a chronological and succinct review of such patents, taken in the United States or elsewhere, as more particularly involve the direct and practical application of the distinct methods enumerated.

America can claim the credit of having originated the first device which can be called an ice machine. It was of this class we have called the sixth method, in which the refrigerating effect is obtained by the evaporation of a volatile liquid and the subsequent condensation of its vapors under pressure and cooling.

THE INVENTION OF JACOB PERKINS.

As early as 1834, Jacob Perkins, an American, well known by other inventions, patented in England the principles of such a machine. His arrangement consisted of a vessel immersed in water, from which ether was pumped as vapor into another vessel, the condenser, and therein recondensed by the pressure produced by the pump and the cooling obtained by circulating water externally to the condenser, the restored liquid flowing back of itself into the exhausted vessel. Around this vessel ice was collected, which had to be broken off or otherwise detached. Though capable of small uses, as constructed the apparatus was not introduced into practice, but the description of Perkins, its critical examination of the conditions of the problem, covered the fundamental principles of this method of refrigeration, and paved the way to future discoveries.

PROF. TWINNING'S PATENTS.

Following the invention of Perkins was that of Prof. Twinning, of New Haven, another American, who can be said with justice to have been the first one to have combined a really practical device for the production of ice with economy and on a commercial scale. It was patented in England in July, 1850, and later on, in 1853, in the United States. The patent covers, under certain modifications, all the practical machines since operated, whether in this country or in Europe, by the evaporation and restoration of volatile liquids; and as such its description can be taken as applying, in all the principal features, to the apparatus of this class of our day.

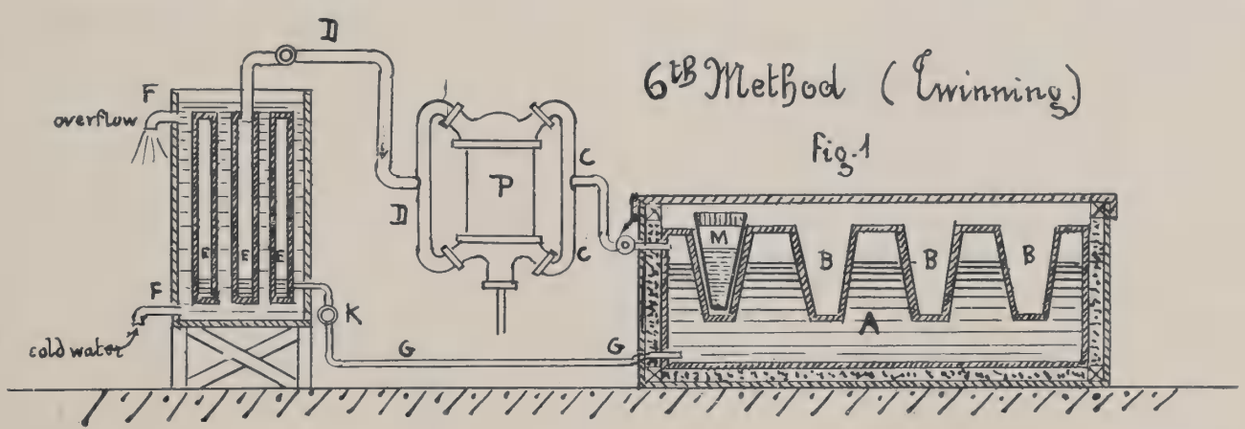
"The inventor explicitly describes four distinct and simple modes of combination, by means of which an exhaust vessel, the refrigerator, or expander, an exhausting and compressing pump, a condenser, or restorer, cooled by a circulation of water, may be applied to the manufacture of ice in bulk." The cold produced by the evaporation of the volatile liquid in the refrigerator under the action of the pump was applied by Twinning "either directly to cool substances or to make ice," the exhauster, or refrigerator, being specially constructed for such purposes; or "indirectly, to cool an uncongealable brine, in which were placed the vessels containing the water to freeze, or which could be used for any other purpose of refrigeration."

All these modes of operating are fully described in the invention of Twinning; in fact, he anticipated in principle all that has been done since. Improvements in the device to obtain the same results in the most economical and satisfactory manner, the substitution for the ether of other liquids to generate the cold have formed the basis of very valuable subsequent patents, but the main conditions of the problem had been thoroughly and scientifically discussed by Twinning.

His first experiments were made as early as 1848. In a memoir published by him in England, he states that "one pound of ether, by its evaporation, is adequate to produce $1\frac{1}{8}$ pounds of ice from water at 32° F., besides cooling down the ether to 28° F." He determined completely the proper surfaces of cooling of the water and of the condenser necessary for the production of a given quantity of ice, the mechanical power required to operate the pump; in other words, the real data of the question, as far as they related to ether. His first machine had a capacity of one ton of ice in twenty-four hours. The protracted experiments made with it were so successful and thorough that Twinning was asked to prepare estimates to establish, in New Orleans, a plant of a capacity of eighty tons daily. He estimated "the total cost at $160,000, with machinery complete, buildings and grounds; and the daily expenses, maintenance,

fuel, wages, oil, repairs to machinery and building, ether and all contingencies, at $120 per day, to which he added $26.30 per day for interest at six per cent on the investment, bringing the total daily cost, for eighty tons, to $146.30, or $1.83 cents per ton." These figures are remarkable, and if we quote them verbatim from the memoir of Twinning (as reproduced by Prof. Barnard, of Columbia college) it is because they are instructive in a history of refrigeration, as showing how complete and practical had been the studies of Twinning on this subject. Making proper allowances for the time at which these calculations were made, and the little efficiency obtained then from the steam engine and boiler, they come almost within the limits of modern calculation. The scheme failed, owing to the timidity of capitalists. Had it been carried through, artificial refrigeration would have taken at as early a date as 1880, the prominent place it has assumed since in the industries of our day.

The regretted Prof. Barnard, late president of Columbia college, commenting on this subject in 1867, says: "It cannot be too much regretted that an invention of such merit and importance, of which the soundness and economical value had been so fully demonstrated, both theoretically and experimentally, should, through the apathy or timidity of capitalists, have been permitted to be neglected in the country in which it originated until foreign enterprise had seized upon it and developed it into a great industry."



We give above a scheme (Fig. 1) illustrating Twinning's patent.

AA is the refrigerator, or exhauster, which is filled to about three-fourths of its height with the refrigerating liquid, the ether. This vessel is properly insulated to avoid losses by radiation. In the cavities *B B B* of the vessel *A* are placed the molds *M M* containing the water to be frozen. These molds fit loose in the cavity *B*, and, in order to obtain an intimate contact with the cooled surface of the latter, a very small quantity of strong brine is poured in *B B*. *P* is the exhausting and compressing pump, provided with proper suction and discharge valves, and which, exhausting the vapors given off by the volatile liquid of *A*, through the pipes *C C*, compresses them through the pipes *D D* into a tubular condenser *E* cooled by a circulation of water *F F*. The restored liquid, accumulating at the bottom of the condenser by the liquefaction of the vapors under cooling and pressure, is constantly returned by the pipe *b b*, provided with a regulating cock *K*, to the exhauster, or refrigerator, *A*, thus rendering the operation continuous. The evaporation of the liquid in *AA* under the exhausting action of the pump *P* produces an intense cold which, transmitted by direct contact to the sides of the cavities *BB*, and, then, indirectly through the strong brine they contain to the molds *MM*, soon freezes the water in these molds. In the machine of Twinning the blocks of ice had a volume of about one-half cubic foot, being six inches thick, and weighing about twenty-five to thirty pounds each.

In the second and third arrangement described by Twinning, and employing essentially the above freezing combination, he anticipated two patents subsequently taken in the United States, one by T. C. S. Lowe in 1867, for the use of liquid carbonic acid instead of ether; and the other covering a disposition which was practically applied in Ohio, at Cleveland, in 1855, in a machine producing one ton of ice in twenty-four hours. It is the mode which was adopted and employed extensively and on a large scale in England.

In a fourth arrangement described in the original patent, Twinning used, instead of the vessel *A* as exhauster, a tubular refrigerator connected with the double-acting pump; the restored liquid in the condenser being returned as before to the refrigerator, which was immersed in an uncongealable brine contained in a tank properly insulated. This brine, made intensely cold by the evaporation of the volatile liquid in the interior of the refrigerator, was pumped by an ordinary liquid pump into a separate tank, well insulated, containing the vessels in which the water was to be frozen: the brine circulating around these vessels producing a cooling action and being returned by the same pump to the refrigerator tank, to be there restored to its original temperature by passing through the tube of the refrigerator, inside of which the cold was produced by evaporation of the liquid ether it contained. For large productions this was obviously a preferable arrangement.

The scheme in Fig. 2 illustrates this disposition, if not in its details exactly as used by Twinning, at least embodying its essential features, and it can serve as a model of disposition of this class of machines.

P is the exhausting and compressing pump, which can be placed either vertically or horizontally, and which can receive its motion from a steam engine directly or by belt, or from a water wheel, in general from any motive power whatsoever. *R* is the refrigerator, *C* the condenser. *T* is the tank containing the refrigerator, and filled with an uncongealable brine; *p* the small pump which, taking the cold brine from *T*, pumps it through pipes *cc*, in the freezing tank *K*, filled also with strong brine, in which are

immersed the ice molds *VV*, and returns it by pipes *f f* to tank *T*, forcing it through the tubes of the refrigerator, where it is cooled again to return to tank *T*, and so on.

In case of limited productions of ice the molds *VV* could be disposed around the refrigerator *R*, in the small tank *T*, as shown in dotted lines in drawing.

THE GORRIE PATENTS.

In 1851, J. Gorrie, of New Orleans, patented in the United States a process for the manufacture of ice and cold by means of compressed air. It was the realization in practice of the laboratory experiment quoted previously. It referred to the seventh class of machines, mentioned at the beginning of this examination, in which atmospheric air is first mechanically compressed to a fraction of its original volume, thereby being heated, and then, while in this state of compression, is passed through a cooler or is otherwise cooled so as to restore its original temperature, and afterward, when so cooled, allowed to expand in working on a piston, this expansion producing an intense cold. The expanded air, now at a very low temperature, and escaping from the cylinder, being discharged either directly in brine, with which it intermingles and thus cools (as was the case in the Gorrie machine), or received on a channel forming the sides of a metallic refrigerator, or vessel containing brine, in which are immersed the ice molds, or the brine, once cooled, can be used for any other purpose of refrigeration, or the cold air escaping from the expanding cylinder can be also used directly for cooling purposes.

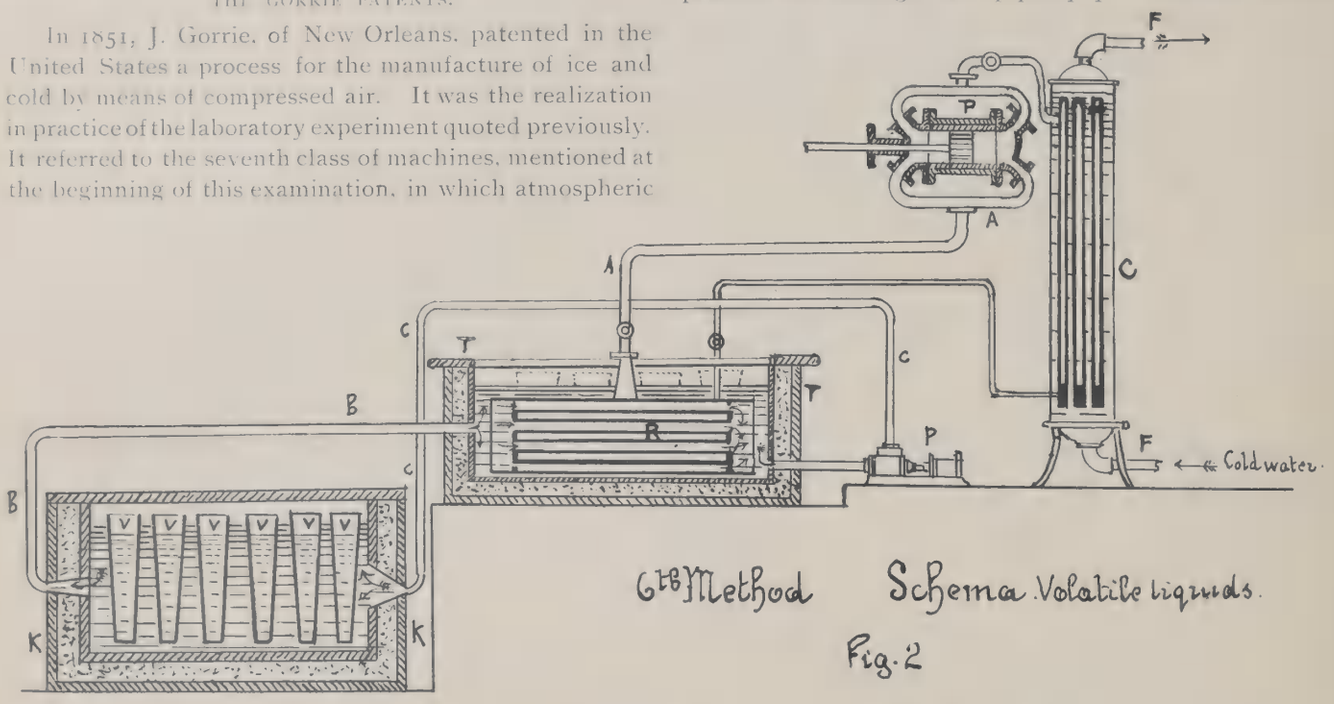
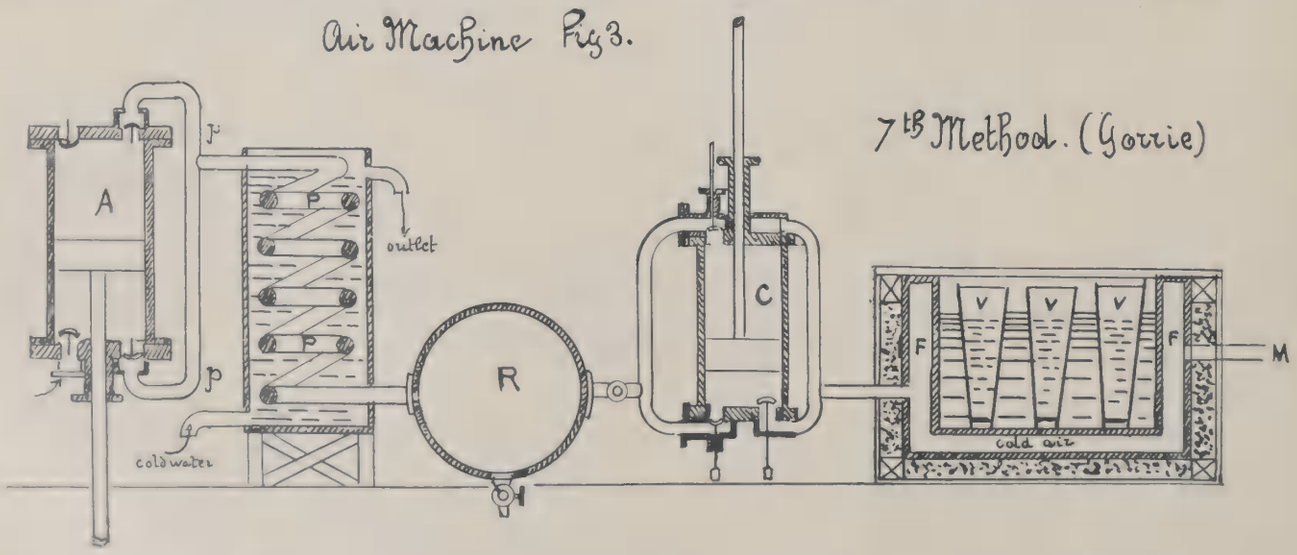


Fig. 2

We give in Fig. 3 a scheme illustrating the general mode of working of such machines. *A* is a large double-acting force pump taking the atmospheric air from outside and compressing it to the proper pressure; *P* is the cooler, an iron or copper coil around which water is caused to circulate, and which receives the heated compressed air through the pipes *p p*. In the Gorrie machine the air was cooled, besides, during the compression itself by an injection of water in the cylinder *A*, a small pump, not shown in drawings, being used for such purpose. From the coil *P* the cooled air passes into a reservoir *R*, having a capacity representing twenty to thirty times that of the pump *A*; this receiver *R* acts as a regulator of pressure, and in it the cooled air is compressed to the amount of compression obtained in *A*. It is provided with a cock at the bottom (wherever an injection of water in *A* is used) to allow of the running out of the moisture condensed from the air. From *R* the air is expanded in the double-acting expanding engine *C*, provided with proper valves and cocks, and properly insulated to avoid losses of cold by radiation. By its expansion the temperature of the air falls to many degrees below 0° Fahrenheit, and this intensely cold air

Air Machine Fig 3.



escapes from the expander engine *C* into the freezing box *F*, well insulated and filled with brine, in which are placed the ice molds, and after having produced its cooling effect is finally discharged into the pan, then into the atmosphere at *M*. In later machines this freezing box *F* has been hermetically closed, and the *same air* taken from this box itself by the pump *A*, after it had been previously and thoroughly dried by chemical means, has been compressed, thereby heated, then cooled and afterward expanded, as explained before; being discharged, when thus made intensely cold by expansion, into the box *F* to be taken by pump *A* and compressed again, and so on, special devices being used for such purposes.

In the Gorrie machine, the cylinder *C* was surrounded by an envelope thoroughly insulated, forming a tank in which was filled the brine which was then cooled directly by contact with the metallic sides of the cylinder *C*, made cold by the expansion of the air, as explained above, and further cooled by being injected in the cylinder *C* itself, during the expansion, by means of a small pump, not shown in the figure, taking the brine from the reservoir forming the envelope of cylinder *C* and forcing it in the cylinder to intermingle with the cold air, to be returned finally to the same reservoir or tank, from which it could be taken for any purposes of refrigeration. The Gorrie machine, though far from realizing all the improvements that this method comported, and which it has received later from the hands of other inventors, marks another stage in the history of refrigeration. Thus we see that, as early as 1850, two of the principal methods for generating artificial cold had received practical and industrial, and one, at least, very successful, applications. In both cases the promoters were American inventors.

[TO BE CONTINUED.]

A QUESTION OF MORALS.

"There is no cold storage warehouse in Texas, where the figs and peaches and tomatoes and the deadly watermelon and the spicy canteloupe can be preserved in abundance," says the San Antonio *Express*. "It is too much like flying in the face of Providence, who has filled the seasons, thus to disturb the regular order of things for the gratification of the appetite. At the same time, such a warehouse would be a source of profit to the stockholders, even if they had to buy the products of the farmers' gardens and orchards when they were cheap, and sell them at a higher price in the winter and early spring."

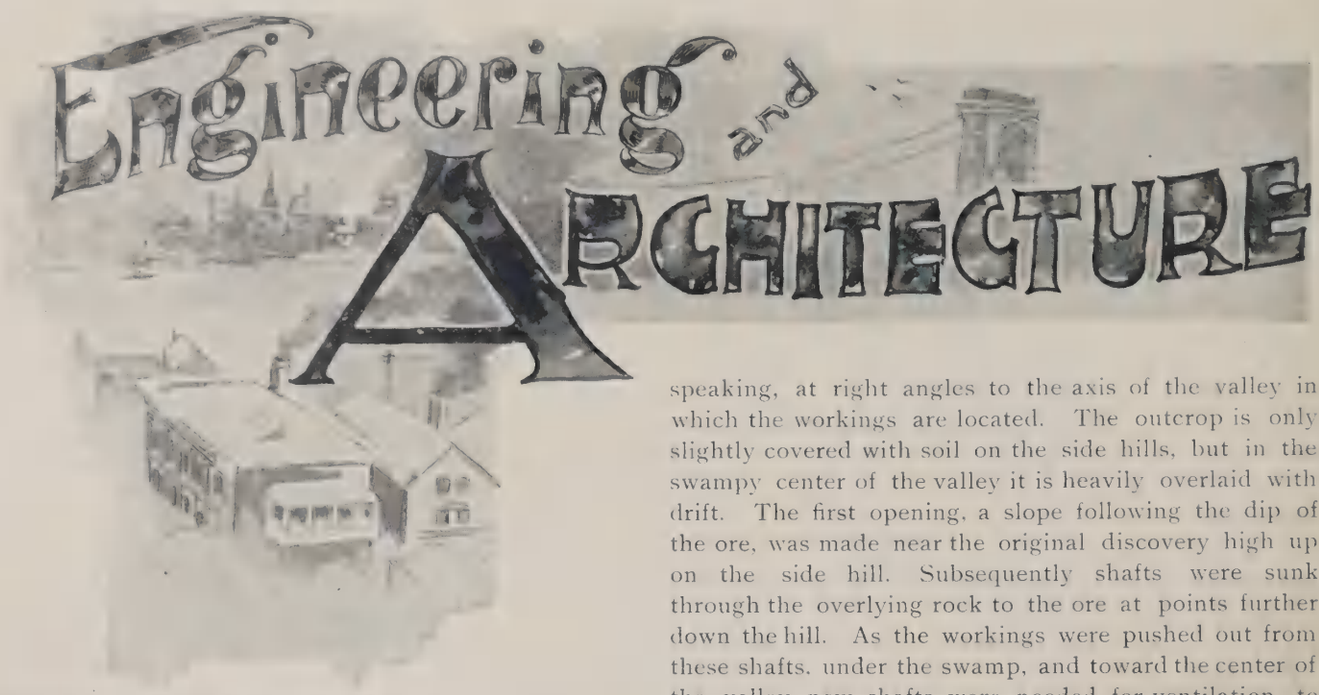
Without stopping to correct the mis-statement of fact, or to criticise our friend's morals, ICE AND REFRIGERATION hastens to relieve the mental distress that must accompany a recommendation to look to the "loaves and fishes," even at the cost of "flying in the face of Providence," by suggesting that there is no "flying" about it. Providence, or Nature, has provided in "the regular order things for the gratification of the human appetite," but has thrown the burden of the preservation of her gifts and their judicious use upon man, the beneficiary.

Man comes naked into the world, but it is not begging a quarrel with nature for him to clothe himself. Nature, too, provides her bounties of "corn and meat" for man's preservation only in the "regular order" of the seasons. Shall he then "stuff" himself like the Indian, only when the grain is ripe, or the ox is killed at the agency, and, wasting all that he cannot eat on the spot, starve himself until the next return of harvest?

Our good friend of the *Express* may dismiss his anxiety. Let him but stop to consider Nature's own economies, and the hints she is constantly giving to man for their improvement by the exercise of his ingenuity, and he must see that cold storage is but the multiplication of her bounties by extending her seasons and duplicating her gifts to mankind by methods she herself suggests to him. Did our friend ever think of the lesson taught by the mountains—Nature's own great cold storage houses? "The Alps," says Dr. Lyman Abbott, in one of his Summer Sermons, "are Europe's refrigerators. The air is chilled on these mountain peaks, descends into the valleys, is heated by the sun, ascends again the mountain peaks, and thus by perpetual change and interchange of air the world is kept from that stagnation which would be death." And again: "The provident mountain fastens in forms of snow and ice the treasures of waters; it receives and stores them up in enormous quantities for future use." Its peaks are laden with snow, its ravines filled with ice; and from these snow-clad peaks and the ice-rivers of the various ravines flow the streams that water the valleys—the life-givers of the continents. "The clouds may forget their mission, or the winds may fail to bring them, but the rivers that flow from these reservoirs of God never fail." The African sirocco from the Saharan desert, where intolerable heats are more deadly than the cutting winds of the Arctic zone, crosses the sea and strikes upon the ice and snow covered peaks of the Alps; and the winds, laden with the moisture caught from these great reservoirs of nature, pour down on the northern plains their treasures of rain, endowing all Europe with rich, fertile life. The fruits and grains of Europe are the children of the "cold storage" of the Alps and the furnace heats of the African desert.

So nature, in all her operations, acts in a compensatory manner. Some things which we have at one time or another considered as great evils, as the severity of winter, will generally be found, upon closer examination, to be accompanied by circumstances which either mitigate or present them in the light of disguised blessings. At the same time, nature is constantly throwing obstacles in man's way to compel him to overcome them by his own exertions and the exercise of the inventive faculty with which she has endowed him. He would never have attained to his present perfection of civilization if he had not suffered under successive inconveniences and hardships, which impelled him to seek methods of remedy, and having been forced to conquer nature for self-preservation, can it be said that he is "flying in the face of Providence" if he also enjoys the luxuries which his inventive faculty has brought him while he has been providing himself with the actual necessities of life?

IT IS said that a good way to preserve ice in a water pitcher is to fill the pitcher with ice and water, set it on the center of a piece of paper, then gather the paper up together at the top, and draw the ends tightly together, placing a strong rubber band around the coil to hold it close, so as to exclude the air. A pitcher of ice water treated in this manner has been known to stand over night with scarcely a perceptible melting of the ice.



[*Reprinted from the* SCHOOL OF MINES QUARTERLY.]

REFRIGERATION AND ENGINEERING.

THE FREEZING PROCESS AS APPLIED AT IRON MOUNTAIN, MICH., IN SINKING A SHAFT THROUGH QUICKSAND.

BY D. E. MORAN.

The freezing process for excavating in quicksand was first employed in 1883, by F. H. Poetsch, a German mining engineer, at a shaft sunk at the Archibald lignite mine, near Schneidlingen, Prussia. The shaft had been carried by the ordinary process to a depth of over 100 feet, and was within eighteen feet of the lignite when a layer of quicksand was encountered. Other methods having proved unavailing, Herr Poetsch drove pipes through the quicksand, circulated a refrigerating brine through the pipes, and eventually froze a wall of quicksand five feet thick around the proposed shaft. Inside of this wall, the excavation was continued and the lining carried down until a junction was made with the lignite.

Following this, in 1884, Herr Poetsch sank a shaft for Dr. Werner Siemens at the Centrum mine, near Berlin, passing successfully through 107 feet of quicksand. Two shafts were sunk at about the same time at the Emilia mine, near Dobriluk station, on the Berlin-Dresden railway. At the Houssa colliery, in Belgium, the process was employed in a layer of quicksand forty feet thick, which was encountered at a depth of 195 feet. At the Max mine, near Michalkowitz, a sudden flow of water resulted in the abandonment of the work. This failure is said to have been in no way chargeable to the process. At Stockholm, in 1885, Captain Lindmark, of the Swedish Royal Engineers, employed the process in driving a tunnel heading eighty feet through loose wet gravel, without disturbing the foundations of buildings which were immediately above the tunnel. This was the first attempt to use the process in tunneling.

In America the process was first employed at a shaft sunk at Iron Mountain, Mich., for the Chapin Mining Co., as is hereafter detailed.

General Description of the Location of the Shaft.—The strike of the ore body at the Chapin mine is, roughly speaking, at right angles to the axis of the valley in which the workings are located. The outcrop is only slightly covered with soil on the side hills, but in the swampy center of the valley it is heavily overlaid with drift. The first opening, a slope following the dip of the ore, was made near the original discovery high up on the side hill. Subsequently shafts were sunk through the overlying rock to the ore at points further down the hill. As the workings were pushed out from these shafts, under the swamp, and toward the center of the valley, new shafts were needed for ventilation, to shorten underground and surface haulage, and also to enable the mine to be drained at the point where the lift of the pumps would be at a minimum. For all these purposes, the most desirable location for a shaft was the center of the valley. But the difficulty of sinking increased as the location of the shaft left the hillside and entered the swampy bottom lands.

The material overlying the rock in the central part of the valley is largely fine sand, having a little clay mixed with it. In the presence of water this material is very unstable; as the miners put it, "it will run where water will," and it is very destructive to pumps. Through this sand occur layers of gravel and boulders. Many of the boulders are of large size, and so closely packed as to give the effect of having been laid by a mason.

The water level in this material was originally about up to the surface level of the central part of the valley. Pumping and surface drainage reduced it generally before the commencement of the work to be described, but the country was still "a lake with its bed just above water."

The mining company made several attempts to get a shaft down through this swamp, but failed entirely, only demonstrating the difficult nature of the undertaking. Finally, in 1887, a contract was entered into with the Sooysmith-Poetsch Freezing Co., the owners of the American patents covering the freezing process, by which the latter agreed to sink a shaft of circular section to the ledge at a point where the overlying material was not over 100 feet thick.

The location selected for the shaft was in the center of the valley, close by the small stream which carries the surface drainage of the small tributary watershed. It was, therefore, at the lowest level possible. In reference to the ore body, it was located so as to go down in the country rock on the foot wall side, the experience of the mining company having been that shafts going through the hanging wall are short lived. Trial borings showed that the drift overlying the rock was ninety-five feet thick at the center of the shaft, and that the water level stood to within ten feet of its surface. This water level was

below the normal, having been reduced by pumping operations, at neighboring shafts, and subsequently varied considerably from the same cause.

Preliminary Work.—The original design was for a shaft circular in section, with a lining of cast iron plates. On this basis it was decided to sink twenty-six 8-inch pipes vertically through the drift to the ledge, so arranged in plan as to be equally spaced around the circumference of a circle of twenty-nine feet diameter. The pipes had to be nearly vertical, absolutely tight under pressure, and their lower ends had to be securely closed. It was decided to be impracticable to sink these pipes independently and have them fulfill the requirements, so 10-inch pipes were sunk first to serve as temporary casings, inside of which the 8-inch pipes might be put into position with safety. To do this, a pipe-sinking derrick was erected on the site, and so arranged as to revolve around a heavy pivot at the center of the shaft, the weight of the structure coming on loose wooden rollers. These rollers were truncated cones, whose common apex was at the center of the shaft. They rested on a circular sill of heavy timber. The whole structure was so designed that the center of the guides for the pipe was fourteen feet six inches from the center of the pivot, and hence the location of the pipes on the 29-feet circle was insured.

In order to force the 10 inch pipes through the layers of heavy boulders, it was found necessary to resort to such extreme measures that several lines of pipe were broken or bent, and had to be withdrawn. The following means were employed:

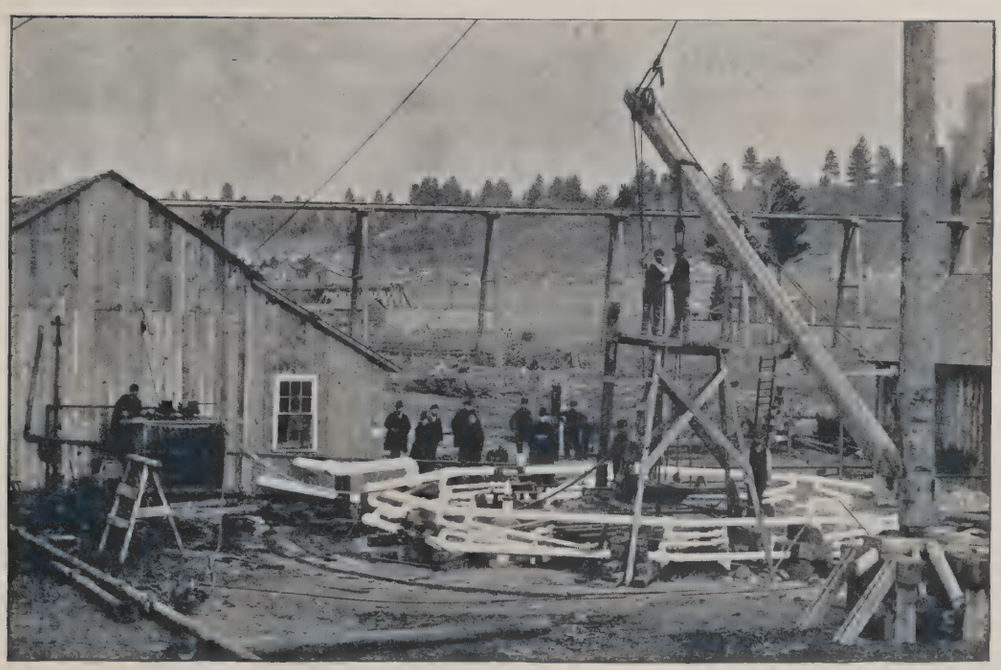
1. An ordinary pile driver ram, with wooden follower. The follower fitted over a cap which was screwed on the upper end of the pipe. The cap protected the screw threads, while the follower served as guide to the pipe, and reduced the upsetting effect of the hammer.

2. A rotating device, driven by gearing from a steam engine, used to revolve the pipe, while a cast steel shoe, with hardened steel cutting teeth at the bottom of the pipe, made a boring tool.

3. A water jet going down to the shoe through a pipe of smaller diameter inserted in the 10-inch pipe.

4. A platform carrying heavy weights arranged to bear down on the pipes, and used in connection with the jet and rotating device.

As soon as a 10-inch pipe was in position, with its lower end some inches into the ledge, a line of 8-inch pipe was lowered into it, the first section having previously had its lower end closed by welding in an iron plug. The 8-inch pipe was made of $\frac{3}{8}$-inch iron plate, the sections going together with male and female taper screws cut out of the thickness of the pipe, making a flush joint inside and out. As each joint was made, it was tested under heavy water pressure, and if tight, the line was lowered the length of a section, and the next joint made and tested; and so on until the entire length was completed. Then the 10-inch casing was drawn, with the use of water jet, leaving the 8-inch pipe in contact with the soil. In this way, twenty-six lines of 8-inch pipe, varying in length from eighty-seven to ninety-seven feet, were put in position. This part of the work was one of great difficulty, owing to the number and size of the boulders encountered. Under the terms of the contract it was done by the Chapin Mining Co., and upon its completion the work was turned over to the Freezing Co., by whom all subsequent operations were conducted.



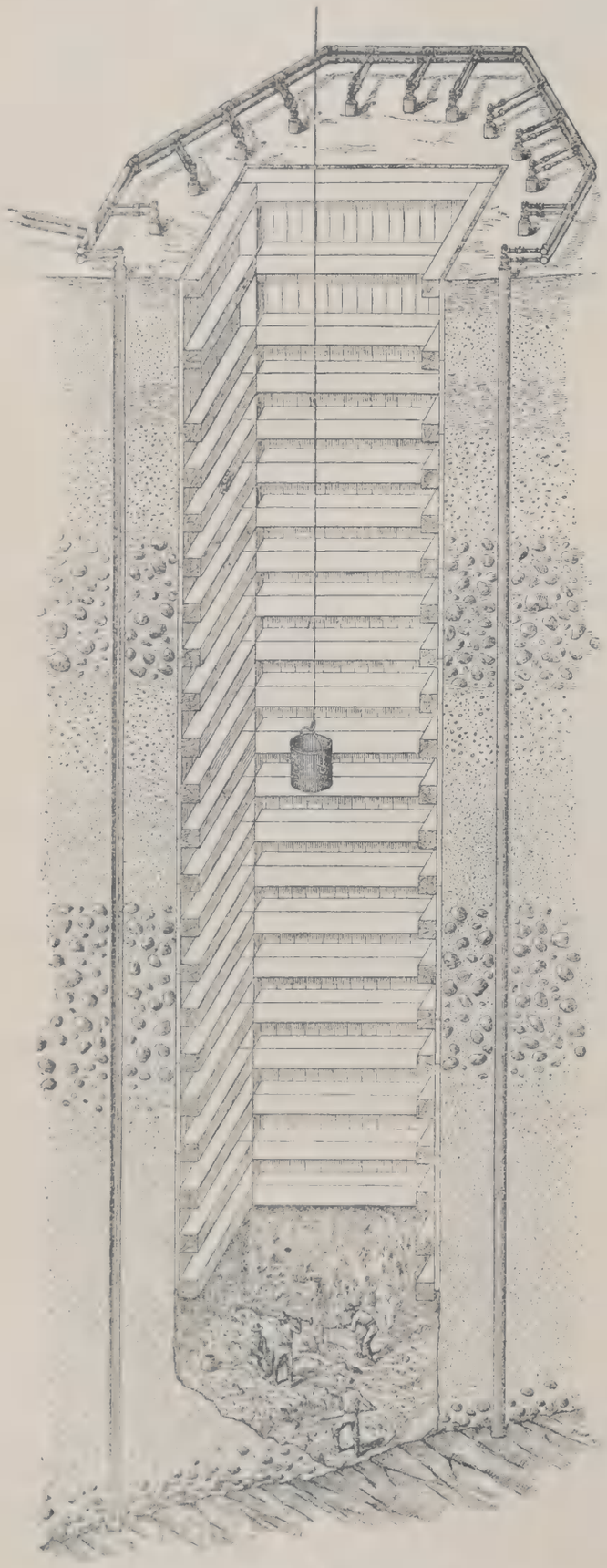
GENERAL VIEW OF SITE, SHOWING PIPE CONNECTIONS, PLANT HOUSE AND DERRICK. TAKEN FORTY-EIGHT HOURS AFTER STARTING MACHINE.

Refrigerating Machine and Connections.—A Linde ice machine (ammonia compression type), of fifty tons refrigerating capacity, built by the Fred. W. Wolf Co., of Chicago, was put in position close by the circle of pipes. A brief description of this machine may be of interest, although it is immaterial what machine is used, provided the required capacity is obtained. The machine, in common with others of its type, possesses the following essential parts:

1. An ammonia compressor or pump, with suitable motive power.

2. Pipe coils surrounded by constantly changing cooling water. In these coils the compressed and

heated gas coming from the ammonia compressor is cooled to such a temperature that, at the pressure existing in the coils, it condenses to the liquid form.



PROFILE OF SHAFT SHOWING ARRANGEMENT OF FREEZING PIPES AND CONNECTIONS.

3. A valve, regulating the flow of the liquid ammonia from the above-described coils into—

4. A second set of pipe coils, surrounded by brine or other vehicle. The liquefied ammonia passes from the regulating valve into these coils, and immediately expands, absorbing the necessary heat from the surrounding brine. From the coils the gas is led back to the compressor, completing the cycle.

The motive power for the ammonia compressor was furnished by an Allis-Corliss engine connected with the compressor by a shaft carrying a heavy fly wheel. The engine was 18″ × 42″, used compressed air* at sixty pounds pressure, and developed 55 H. P. at 60 r. p. m.

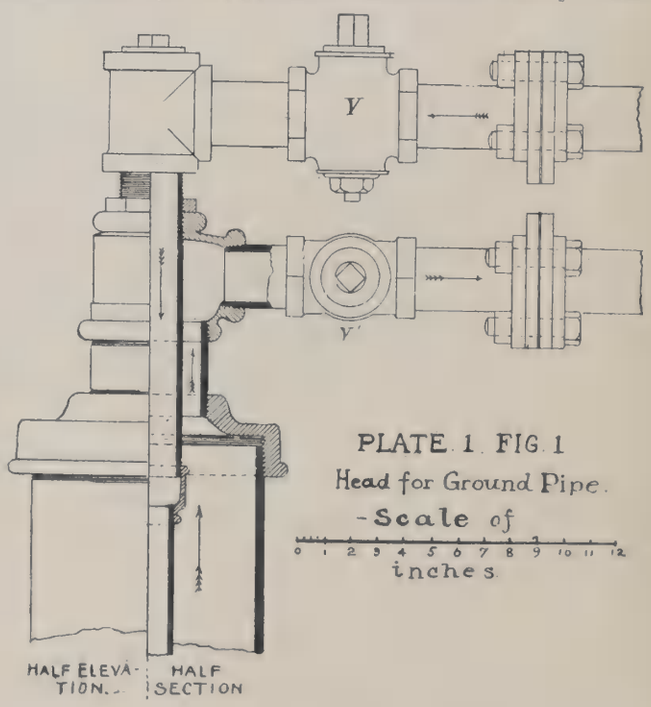
The ammonia compressor was of simple design, and had ample bearing surfaces, so that a seven months' run was completed without any shut down for repairs or hot bearings.

It is much to be regretted that no test was made of the efficiency or capacity of the ice machine under the conditions existing at Iron Mountain, as it would have been of great interest to know the total number of heat units taken from the soil, to compare with calculations based on the observed effects.

The brine used as vehicle between the refrigerating machine and the soil was a solution of the impure $CaCl_2$ of commerce. According to an analysis furnished by the manufacturers, the "chloride of calcium" contains:

	PER CENT.
$CaCl_2$	60
NaCl	5
MgCl	15
H_2O	20

but in one freshly taken sample the percentage of water was at least 30. A saturated solution of $CaCl_2$ is said



to have a freezing point of—40° C. (or F.). No trouble from freezing of the brine was experienced at the temperatures used at Iron Mountain, except when the specific gravity of the solution was below 1.200.

The cooling of the brine by contact with the expansion coils was effected in a 10′ × 10′ tank in which the coils were immersed, the brine being kept in motion by a stirring device.

From this refrigerating tank the cold brine was pumped through a system of distributing pipes and

* The power used at the Chapin mine is furnished by an air compressing plant at the Quinnessec falls of the Menominee river, distant about three miles.

regulating valves to the ground pipes, and after circulating through the ground pipes, a system of collecting pipes returned the brine, warmed by conduction from the soil, to the refrigerating tank. The circulation of the brine in the ground pipes was effected as follows (see Fig. 1):

Each 8-inch ground pipe was capped with a 8-in. to 4-in. reducing coupling, and this connected by a short 4-in. nipple, with a 4″ × 2″ × 2″ tee. The 2-inch side opening of this tee connected with the return system. Through the 2-inch top opening ran a "long threaded" 2-inch nipple with jamb nut above. This nipple extended some eighteen inches below the 4″ × 2″ × 2″ tee, and was there connected by a 1½″ × 2″ reducing coupling with a line of 1½-inch pipe extending down the center line of the ground pipe to within a few inches of the bottom. The upper end of the 2-inch "long threaded" nipple was capped by a 2″ × 2″ × 2″ tee, from the side opening of which connection was made with the distributing system. The brine entered through the top connection, passed down the line of 1½-inch pipe to the bottom of the ground pipe, returning through the annular space between the 1½-inch pipe and the 8-inch pipe, and going out through the lower 2-inch side connection.

The velocity of the brine in the inner down-flow pipes was two feet per second, the brine changing every twenty-five minutes in the ground pipes.

The circulation of the brine through each pipe was adjusted by means of the regulating valves V and V_2, Plate I, so as to bring the temperature of the return streams as nearly equal as possible. This method of regulation was designed to render the effect of each pipe equal in the event of the conditions affecting the pipes being different.

The connecting pipes above ground were not protected in any way, so that immediately after starting the condensation of moisture from the atmosphere coated the pipes and connections with a snow-like ice, which increased in thickness until some very picturesque effects were produced. The coating, moreover, served as a cheap and effective lagging.

[TO BE CONTINUED.]

SUGGESTIONS FOR BUILDING.

A nearly or quite square form is the most economical for an ice house, which nowadays is, as a rule, built above ground. A slanting roof is preferable, though where felt roofing is employed a flat roof, with a very little slope at the rear, may be made, provided the height of the building is such as to secure at least one foot of air space above the upper packing for ventilation. The roof may be of common boards, shingles or other material, provided it is waterproof; it ought to be made with broad eaves. Some builders whitewash both the outside and roof of their houses with a view to reflecting the heat. Ventilation is best gained through a cupola. It will be found convenient to have doors for removing the ice placed at regular intervals, on the north side of the house from near the top to the bottom of the house. Sawdust is usually considered the best material for packing the walls, for the foundation on which the packing is begun, and for covering the ice when the packing is completed; but with the exception of covering the ice itself it is likely that locomotive breeze, when it can be obtained, would be preferable, since it would naturally absorb and hold less water than the sawdust. Wet sawdust is a very poor non-conductor of heat. The usual rule calls for a packing of sawdust one foot thick at the bottom and sides of the ice, and two feet at the top.

A cheap house may be built with single walls, and preserve ice fairly well if a space of fourteen to eighteen inches is left between the walls and the ice, and packed with sawdust as filling in the ice proceeds. For a permanent house, however, it is better to make the walls double and pack the space with sawdust. In packing, the ice ought not to come in contact with the wooden sides. If the walls are double, six or eight inches of sawdust between the walls and the ice will be sufficient. A location on a sandy or porous soil, where the drainage will be mostly absorbed, is desirable. The usual plan is to dig a foundation eighteen inches to two feet deep, in a dry gravel or sandy soil. If the soil is not dry the foundation is dug two feet deeper and filled to that extent with broken stone, coarse gravel and sand. In any case provision should be made for perfect drainage of the ice bed, using clay tiles or sewer pipe, provided with a trap to prevent air from entering the pipes from without. The larger the mass the better the ice will keep. It seldom pays to build small houses.

A FARM OR CREAMERY ICE HOUSE.

James McMillan, of Fairport, N. Y., has on his farm an ice house which he considers very nearly perfect, a description of which he has sent to an agricultural paper. It is twelve feet square. The studding is 2×4-inch stuff, nine feet high, and placed sixteen inches apart. The outside is covered with matched lumber, which is again covered by clapboards. Inside the studding there is a board lining, and the space between is filled with dry sawdust well packed in. Under the building there is a cellar 6½ feet deep. Heavy sills are laid on the wall, with stringers, 4×6-inch scantling, at intervals of one foot. These are crossed by 6×6-inch stringers which run the other way.

A pan of No. 16 galvanized iron, eight inches deep, fits on the top of these stringers, and was put in place before the sheeting was put on. The pan is riveted together every three inches, and soldered. It cost about $15. It is set on an incline of about four inches toward one corner, which is furnished with a waste pipe which discharges into a tank in the cellar. There are double doors for admission into the cellar, with an air space between. The floor is of natural earth, and the average temperature is about 42°. Meat, vegetables and other perishable articles keep perfectly in this cellar, and it proves a good place for storing butter while the ice lasts.

Mr. McMillan thinks that the waste water does not come fast enough to run a creamer, though the amount of ice needed would be very small. The waste water passes out of the cellar through a 6½-inch pipe to the hen house, affording a cool drink for the fowls which are not allowed to roam over the farm during the season of small fruits. In filling the house strips of lath are laid on the bottom of the pan about six inches apart. A layer of sawdust is then put in, and the ice is packed in a solid block in the usual manner. The drainage is perfect. This house will hold about twenty tons, and the advantages in the way of cold storage which the cellar affords increase considerably the amount of service usually obtained from that amount of ice.

LEGAL MATTERS.

SOME RECENT LEGAL DECISIONS—WARRANTY AND SALE OF ICE—ACCEPTANCE OF NOTE FOR DEBT—MINOR LEGAL MATTERS AND NEWS ITEMS.

SALE OF ICE—WARRANTY.

A contract on the part of a seller to deliver at a certain time and place good, clear, merchantable ice is a warranty, or a condition precedent of the nature and effect of a warranty, that the ice afterward delivered was of the kind and quality described in the contract, according to the decision of the supreme judicial court of Maine in the case of *Morse* v. *Moore*. The court said: "That there is a warranty, or a condition precedent amounting to warranty, in the contract there can be no doubt. Such a warranty will be found to be variously characterized in the books as executory warranty, a condition precedent amounting to warranty, in the nature of warranty, with the effect of warranty, equal to warranty and the like. It is immaterial for present purpose whether it be regarded as an express warranty or an express condition implying warranty, as the effect must be the same. One kind within its limit is not a more potential ingredient in a contract than the other, the difference between them being only in the style of agreement to which they may be annexed. An express warranty may be also special, however. It is now well settled by the authorities generally, our own cases included, that a sale of goods by a particular description of quality imports warranty that the goods are or shall be of that description—a warranty which becomes a part of the contract if relied upon at the time by the purchaser. Here there is a clear description of both the kind and quality of the ice, the quality to be merchantable.

* * *

NOTE—ACCEPTANCE—EXISTING DEBT.

The supreme court of Minnesota held in the recent case of the *Combination Steel and Iron Co.* v. *St. Paul City Railway Co.* et al., that the acceptance of a note "for" or "on account of" an existing debt, in the absence of an express agreement or understanding that it is taken in satisfaction or discharge of the debt, is to be understood and interpreted as a conditional payment only, and that the mere recital in a receipt or other writing of the fact of payment by note is not, by itself, sufficient evidence of absolute payment, and that the creditor assumes the risk of its being paid, but is upon the implied understanding that the note will be paid, and only shows that when paid it shall be a discharge of the original debt.

MINOR LEGAL MATTERS.

——Joseph Cloutier, ice dealer at St. Johnsbury, Vt., has made an assignment.

——An execution for $3,732 was issued against Archibald Scott & Sons, wholesale ice dealers of New York, October 2.

——W. P. DeSaussure has resigned as receiver for the Richmond Ice Machine Co., and Col. Tazewell Ellet appointed.

——The property of the Mutual Benefit Ice Co., at Northcast Harbor, Bangor, Me., was sold at auction, October 10, to C. H. Emery, of Ellsworth, for $1,275.

Helms & Co., ice dealers at Milwaukee, have sued Sanbone & Haisler and Armstrong Bros. for $11,205, for non-acceptance of 4,482 tons of ice bought of plaintiff.

——Esch Bros. & Robe, ice dealers, Chicago, have been sued for $15,000 damages by Sam'l Pogoda, a lad, an ice scale having fallen from one of their wagons upon his head.

——C. Sharpe, bookkeeper of the Central Ice Co., Chattanooga, Tenn., has gone wrong. He has disappeared, leaving a shortage of $1,000 to $1,100 in his accounts. His father, in New Jersey, will make good his defalcation.

——In the Monmouth county court at Freehold, N. J., a verdict for $800 was rendered against the Seaside Ice Co., of which H. H. Yard, of Philadelphia, is president, in favor of the Monmouth Ice Co., of Monmouth, Me.

——John Baizley has begun suit against the Northwestern Ice Manufacturing Co., of Philadelphia, to recover $10,973 claimed to be due from the company for the construction of the plant at the Broad Street Farmers' Market.

——The receiver of the Ridgewood Ice Co., of Brooklyn, has begun action to set aside the mortgages made by the company before the failure, the first being for $146,000 to J. L. Downer as trustee, and a second for $120,000 to Wm. L. Husted.

——The Chattanooga Ice and Bottling Co. has applied for a receiver. The nominal assets are named at $128,000, or four times the indebtedness. Slow collections and suits to force the payment of obligations have impelled the company to this step.

——Thos. Bradley, of the Chester (Pa.) Ice Co., has leased the plant of the Preston Lake Ice Co. for five years, beginning October 10. The ice houses will all be put in thorough repair by Mr. Bradley, who takes the lease individually, and not in name of the Chester Ice Co. Mr. Preston has been in the ice trade since 1869.

——The Alcutt Packing Co., of Armourdale, Kan., assigned October 19, to J. J. Squiers for the benefit of the creditors. President W. P. Alcutt said: "Slow collections throughout the country forced this step. Our liabilities are something over $100,000, with assets the same. I hope to be able to pay every dollar that we owe."

——The Arctic Ice Machine Manufacturing Co., of Cleveland, Ohio, assigned October 1. Failure to secure iron needed in the construction of machines brought on a number of suits for breach of contract in January, when the company secured an extension from its creditors. The liabilities are not stated, but it is said they will exceed the assets by $100,000.

——The People's Artificial Ice Co., Chicago, made application, October 6, for a receiver, and for the dissolution of the company. The company was organized in February, 1891, with $50,000 capital. Premises were located at 1278 West Twelfth street, and 500 tons of ice were made and sold this season. The cash paid in by stockholders was $19,600, and the debts amount to $11,000. The company is loser by about $30,000.

——Geo. E. Parker, assignee of the Kansas City Packing and Chase Refrigerator Co. has brought suit in the federal court at Indianapolis against the LaFayette car works, claiming damages of $172,000. The plaintiff alleges that the car works built for it 250 refrigerator cars at a cost of $200,000; that the cars were of an inferior make, unfit for the uses to which they were put, and that the plaintiff suffered great loss in consequence.

——A meeting of the stockholders of the Richmond Ice Machine Co. was held October 16, when, after hearing the reports of the officers and the statement of assets and liabilities made up by the receiver, it was unanimously determined to make an effort to settle the debts of the company and resume business. It was demonstrated that a moderate amount of additional capital would place the company in good shape, and it was determined to raise the necessary sum among the stockholders by subscription to additional stock. Between $6,000 and $7,000 was at once subscribed by stockholders present, and a committee of five was appointed to devise and carry out a plan of reorganization.

THE FIRE RECORD.

——Two large ice houses at Ruthven, Iowa, were burned October 16; loss, $20,000,

——The ice factory at Hopkinsville, Ky., was burned October 5; loss, $2,000; no insurance.

——The Kankakee Crystal Ice Co.'s house at Waldron, Ill., burned October 8; loss, $20,000; insured.

——The Butchers' Ice Co.'s plant at Cleveland was slightly damaged by fire September 19; loss, $200.

——The ice houses of Robinson & Riley, Menasha, Wis., were burned October 2; loss, $4,500; partially insured; ice destroyed, 1,600 tons.

——On September 22, the ice houses of the People's Ice Co., at Bethel, Conn., were burned, and 5,000 tons of ice destroyed; cause, supposed locomotive spark.

——A spark from a steam barge set fire to Jos. Mayer's ice houses (empty) at Becher and Clinton streets, Milwaukee, October 19, which were destroyed; loss, $2,000; no insurance.

——Incendiaries, September 23, fired a large ice house at Sympaug pond, belonging to the People's Ice Co., of Danbury, Conn.; loss, $8,000; insured; 3,000 tons of ice were destroyed.

——Ring's ice factory at St. Louis was burned September 30; loss, $28,000; insurance, $17,000; cause, lamp explosion in the hands of the engineer. The plant was operated by L. G. Kammerer, who represented a company who intended to enlarge the plant for next season. They will rebuild at once.

ICE AND REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION AND THE TEXAS ICE MANUFACTURERS ASSOCIATION.

∴ NOVEMBER, 1891 ∴

SUBSCRIPTION PRICE, $2.00 PER ANNUM.

H. S. RICH & CO.
PUBLISHERS,
177 La Salle St., Cor. Monroe, CHICAGO.
206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

Entered according to act of Congress, in the year 1891, by H. S. RICH & CO., in the Office of the Librarian of Congress, at Washington, D. C.

DAMAGE SUITS.

The law departments of railway companies make it a rule to fight every claim for damages based on bodily injuries to passengers where there is a possible chance of winning, and sometimes where there is not. The explanation as given by a railroad attorney is, that when a man is injured while getting on or off a train in motion, say, the first thing he does is to start a suit for damages, notwithstanding his own carelessness may have been directly the cause of his injury. The individual hurt appeals to the law in the belief that the company will compromise and pay him something, at any rate, though not his full claim, rather than follow a law suit. But the company does not; because, as the lawyers say, if the company did pay without a fight, it would be ruined by the multiplicity of such suits, nine-tenths of which have no real basis of equity to stand.

One feels inclined to recommend such a principle of action to ice dealers, when he notes in the newspaper the character of some of the actions begun against them for damages to children, suing "by their next friend"—their parents generally. As examples, the Chicago courts within sixty days past offer two cases. In the one, the "next friend" sues for $20,000 to compensate for injuries to a four-year-old boy, upon whom a cake of ice fell as the boy was helping himself to broken ice in or under the wagon. In the other, the suit is for $15,000 damages, a heavy ice scale having fallen on a fifteen-year-old lad. Every great and small city is able to duplicate such outrageous demands for damages, arising from the carelessness of the persons injured.

It will not do to say that there is no such thing as contributory negligence on the part of the dealer or his employes, for many drivers are not always as careful as they might be, frequently driving recklessly through the streets, and handling ice with little regard to the rights of pedestrians on the sidewalks; but these offenses are less often productive of injury or damage suits than the causes alluded to in the Chicago cases above, all of which might have been avoided if the children recognized the fact that they had no right to be in the places where the injuries complained of were received. If children are permitted by their parents to promiscuously run the streets, to climb into ice wagons, or hang around or under them for the purpose of stealing or picking up pieces of ice, it ought to be well understood that if they are injured the responsibility rests upon themselves in all ordinary cases; and in cases of actions for damages in such event, it is the defendant's moral duty to resist the claim as he would fight any species of blackmail, and do it in the interest of the public, as well as for the protection of himself. For, as in the case of the railroads fighting similar suits, the only way to put a stop to such demands is to fight them "to the bitter end."

"THE UNIVERSAL."

The city of Memphis, Tenn., was the scene, during the last ten or twelve days of October, of the trial of a case in the United States District Court, which is interesting to the ice and refrigeration trades. The suit was brought by W. B. Chapin, of New York, against J. S. Fargason, of Memphis, and Frank A. Smith, of Pennsylvania, the plaintiff Chapin suing to recover $75,000 damages, which, he claims, he sustained in a transaction relative to a patent right "ice machine," the deal occurring in August, 1887, when Chapin was a resident of England. The plaintiff sets forth

that in August, 1887, at the special instance and request of the defendants he purchased a certain patent and patent right for the Eureka ice machine and refrigerator, and the right to manufacture and sell them, including all patents and rights therefor for Great Britain, India and all the British colonies except Canada and Australia, for £10,000 sterling, cash in hand, and £10,000 sterling, payable in the stock of a corporation thereafter to be formed in England for the manufacture and sale of the machine. The defendants warranted the invention, or machine, to be the most complete, simple, safe and economical system of refrigeration ever perfected, and that in the use and operation of said machine for making ice and for refrigeration purposes no pressure, foundations, gauges, water for condensation, dangerous carboys, complicated machinery nor experienced engineers were necessary or required; that by a simple combination of two elements, and the use of said machine, water could be brought to freezing point in three minutes; and that the machine could be managed by any boy, woman or man; and that with the smallest sized machine or house refrigerator and eight gallons of drinking water ten pounds of ice could be produced per hour; and that in the use of said machine there was no wear, tear or getting out of order; and that with it a hotel, saloon, meat shop or grocery refrigerator could be so arranged as to have a dry, cold air, instead of a wet, flabby air, as with ice. They sold to the plaintiff the patent right to manufacture the same. He charges that the machine at the time said representations were made, and at the time of sale, was "utterly worthless and of no value, and incapable of accomplishing the purpose, or any of the purposes, in the manner or form as represented, and was wholly unfit for use, and not capable of being operated in the manner and with the results represented, and has so remained and continued."

This suit is part of the aftermath of the famous "Eureka Refrigerating Co." "sell" of London (1887) and the "Universal Refrigerating Co." craze, which, after being quietly boomed in Washington and the West, in a certain way "startled" the American world, along in April and May last, when the New York *World* hoisted Frank A. Smith and his "refrigerine salts" into general publicity, along with Gen. Green B. Raum and divers New York gentlemen, as officers of the "Universal" company, by an article entitled, "Refrigeration without Ice," occupying a whole page, and decorated with numerous pictures, including one of a "modern refrigerator," with tapestry hangings and an Axminster carpet, wherein

sits a youth in "fine raiment" puffing a cigar, and gazing on a pyramid of tropical fruits of appetizing mien, at his elbow a champagne cooler, generously filled, the whole cooled by a coil of pipes in the rear center, and an "ice cream freezer" jacket, with a triplet of stop cocks, on the outside, in the right foreground; also wood cuts of Green B. Raum, of "Inventor Frank A. Smith," etc., engraved with a circular saw and a router, not forgetting even the faithful 'broncho"—"the short but simple animal of the poor"—who meekly pursues his devious way, loaded with a pair of packing cases and a pensive air, labeled "Field Refrigerator—for Use of Armies and Expeditions." [It has been suggested that the "modern refrigerator" looks like a modern electrocution machine, loaded, but it is unnecessary to harrow the feelings of the "Universal's" stockholders by dwelling on the similitude.]

Chapin was a well known New York broker until 1887, when he met Smith, who loaded him up with enthusiastic ideas of the wonderful possibilities of his "refrigerine salts," when the pair hied themselves to London and organized the "Eureka Refrigerating Co.," capital £100,000 in shares of £1 each, the object of the company being to bring ice making and refrigeration "within the reach of the humblest," at a "merely nominal" cost, by a process so simple that even the servant girl could run it and err not—put a shovelful of salts and an equal weight of water into a pail and, presto! the machine does the rest. Smith, with true American modesty, asked only £25,000 for the patent rights for "Great Britain, India and all the British colonies except Canada and Australia." The British public was interested in salts only £13,800 worth, however, when Smith graciously conceded £13,000 of his price, and, having received £12,000, came back to America. Chapin, finding the bottom had dropped out, says he reimbursed the angry English stockholders, and then also came to America to find Smith, beginning suits against him aggregating $89,000, claiming Smith had defrauded him to that extent; and one of these suits was the one on trial at Memphis, which ended on October 26, when Judge McCammand ordered the jury to find for the defense in a lengthy charge. In effect the court ruled that Chapin bit at the "ice machine" bait offered by Smith with his eyes wide open, and he knew what kind of business he was putting his money in when he parted with his shekels. The case will be appealed by Chapin to the United States Supreme Court.

After the failure of the "Eureka" concern, Smith and his "refrigerine" were not heard of again until in 1890, when both reappeared in Washington, under the patronage of Gen. Green B. Raum; and the "Universal Refrigerating Co." was launched from West Virginia, where corporation laws are large and liberal. Branch companies were organized in Washington, Pittsburgh, Chicago, etc., etc., with large capitalization, and local and state rights offered for sale, on the basis of experiments with the "salts" conducted in hotels, etc., and an unsuccessful attempt made to have it introduced in the United States navy. Just how much money was invested in the scheme throughout the country is not known, but it was considerable—much more than will ever come back to the stockholders, for after the gullible had indorsed it, science began to look into it, speedily announcing that the theory on which the "Universal" is based is, commercially, a fallacy and impracticable.

Chemical analysis of Smith's "refrigerine salts" shows them to be simply "nitrate of ammonia," which has been known to chemists as a refrigerating agent for generations, and was described as such by Glauber as early as 1640. It will produce 46° of cold; that is, a mixture of equal parts of nitrate of ammonia and water will produce a brine the temperature of which will be 46° lower than that of the water before mixing. The obstacles in the way of its commercial use as a refrigerating agent are, (1) nitrate of ammonia is too costly; (2) it destroys the metal pipes by corrosion: (3) requires too much labor to handle it; (4) requires the evaporation of the water before the nitrate can be re-used; while (5) the value of nitrates lost in evaporation is greater than the value of the ice made or refrigeration performed by it under the most favorable circumstances. It should be said for Smith, that in the specifications of his patent (349,064, September 14, 1886) he does not claim patent for the refrigerating agent, but simply for an arrangement of pipes in a refrigerating box, which, as one writer has briefly described, is the astute "suggestion that if you pour liquid into the top of a pipe it will, unless stopped by something, run to the bottom"!

It really seems amazing that in these days any one could be deceived by the theory of the "Universal" patent rights; but men were, it seems. It has served its turn—a few have the money; a great many, the experience. *Vale* Universal.

A commendable charity in the South is "The Ice Mission," which is organized at Richmond, Charleston and other Southern cities. In Charleston the report of the summer's work has been published, showing that the ladies have collected and expended $176 in ice. This, with the discount of twenty per cent allowed by the ice company, makes the amount expended $211.20. The ice was distributed among sixty-six families monthly. The success of the mission was largely due to the collections from the boxes in the various places of business.

"Bad water and dirty ice," says the railway surgeon in the *Railway Age*, "cause millions of cases of gastric intestinal diseases among passengers." The "pure ice" crank, of course, charges all to the ice; but if any one will point out a place where less care is taken in washing and handling ice than in a railway yard, and where meaner water and dirtier tin cups can be found, barring a public street drinking fountain, than in the average railway car, he will be entitled to honors of "explorers to their majesty, the people."

The editor of Ice and Refrigeration would like to create a department under the heading of "Trade Letters," to be made up of facts, experiences, suggestions, etc., given in short, pithy letters from the readers. We don't care a fig about spelling, grammar or rhetoric. If the communication is intelligible, we will arrange all such things, and no one need have any apprehension or hesitancy on that score. Be sociable, and give the trade the benefit of your experiences, which will be reproduced for the general good.

ANSWERS TO CORRESPONDENTS.

POSITION OF ICE IN BOX—CONFINING AMMONIA—AMMONIA PRESSURE IN RETORT—UNDISTILLED ARTESIAN WATER FOR ICE—TEMPERATURE IN FERMENTING ROOMS.

[This department of ICE AND REFRIGERATION will be conducted for the benefit of the trade generally, as well as individuals, and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

To the Editor: Does it make any difference in the cooling power of a piece of ice, if it is laid in the ice box in the same position in which it was formed, or otherwise? S. K. C.

ANSWER.—It makes no difference at all, as far as the amount of the total refrigeration is concerned; it might, however, melt somewhat quicker in one position than in another, thus dispensing refrigeration more readily, yet for a shorter time, as it were. This difference, if it really exists, cannot but be very small, almost insignificant, we should say.

To the Editor: It is stated that anhydrous ammonia is so volatile that it cannot be liquefied except at a very high pressure, yet the other day I saw this very substance, kept in an ordinary bottle with a common stopper, at the temperature of the atmosphere. Can you solve this conundrum? H. P.

ANSWER.—We cannot, except on the supposition that the stopper did not fit tight; in this case the ammonia evaporating might create enough cold to keep the liquid ammonia below its boiling point under the ordinary pressure of the atmosphere.

To the Editor: Can artesian well water, in its natural state, be used for the production of artificial ice, or must it be distilled before? TH. K.

ANSWER.—Distillation is not absolutely necessary, but it is hardly possible to make an ice quite clear without it, since artesian well water generally contains much mineral water, which, although not unwholesome, still increases the cloudiness of the ice, as it is separated partially during freezing.

To the Editor: What is the proper temperature to be maintained in storage and fermenting rooms in lager beer breweries? PH. Z.

ANSWER.—The temperature in the storage rooms should be about 33°, and in the fermenting room about 40° F.

To the Editor: We would like some expert to tell us what pressure we can get on a retort that is one-tenth full of aqua ammonia (26°) providing it is at a temperature of 200° F. Also if there is any rule governing temperature of ammonia gas at different pressures in an absorption machine and corresponding temperature in a compression machine. The point we wish to know is what the temperature is when it enters the pipe leading to the condenser. H. C.

ANSWER.—Below we print Regnault's table of pressure of ammonia gas at various temperatures, measured in millimeters of mercury. By this table, at 90° C. or 194° F., ammonia has a pressure of 750 pounds to the square inch. In this case, the interior contents and exterior surface of the vessel is at 90° C., and the vessel is closed, consequently 750 pounds, is the nearest answer we can give to your first query, and not allowing any variation for the conditional $\frac{1}{10}$ volume of still in aqua ammonia and $\frac{9}{10}$ space, which should be considered as ammonia gas at normal temperature. Of course this never occurs in any machine, for such a temperature is not necessary for the liberation of gas from aqua ammonia, and the cool condenser acts as a vacuum pump to relieve this pressure. The attached rule of Regnault's should apply to any make of machine. Ammonia gas is usually compressed in machines to about 150 to 160 pounds, and, according to Regnault's table, would then have a temperature on entering condenser of 30° C. or 86° F.

Liquid ammonia vaporized in a closed vessel, the vapor pressures according to Regnault are as follows, in millimeters of mercury:

Degrees C.	Millimeters.	Degrees C.	Millimeters.
—30	866.04	+ 40	11,595.30
—20	1,392.13	+ 50	15,158.33
—10	2,144.62	+ 60	19,482.10
0	3,183.34	+ 70	24,675.55
+10	4,575.03	+ 80	30,843.09
+20	6,387.78	+ 90	38,109.22
+30	8,700.97	+100	46,608.24

760 millimeters=1 atmosphere=15 pounds.

To the Editor: Is there any objection to whitewashing the inside of crates used once for cold storage of eggs? Would there be a tendency to moisture arising from the chemical combination of water with the lime in slacking? E. P.

ANSWER.—Mr. D. B. Beemer's previous articles on cold storage of eggs would seem to cover the inquiry, but Mr. Beemer has kindly added the following on this particular query: "The inference is, that it is intended to use such cases, after such treatment, for cold storage purposes again. I would object to the whitewashing of egg cases on general principles. The whitewash is, of course, applied in a liquid form, and this lime solution is, of course, absorbed into the pores of the wood in the drying process. Now, the idea of the inquirer in using the wash is, no doubt, that it will have a disinfecting effect upon any possible taint in the case, or else to prevent it from acquiring a taint, or bad odor. If the cases were only used for ordinary shipping purposes, involving change of air and plenty of ventilation, there would be no objection to offer, perhaps; in fact, it might be of advantage—but to use such cases in the damp, confined air of cold storage rooms would be to incur the risk of having the lime on the cases and in the wood absorb moisture sufficiently to soften it to that extent that it would evolve and liberate the lime odor, which would be absorbed by the eggs, and these last damaged in flavor and quality thereby. It is the nature of lime to absorb and liquefy again, when it has the opportunity. Witness the effects upon that on the walls of rooms when subjected to action of steam; rub your hand or a cloth over it, and it will be smeared with the liquid lime. Eggs will absorb bad smells when subjected to them for a length of time, as readily as butter and milk, and no chances should be unnessarily taken with them in this direction."

E. D. WILCOX, of Clarksville, Iowa, has patented a device for rapidly and successfully cooling butter in warm weather, after it has been placed upon the worker, that keeps chilling it as the work proceeds, all that is desired. It consists of a cone-shaped pan suspended over the worker, in which there is ice and salt. The butter is sprayed with the ice water as the worker revolves, and at the same time the coldness from the ice makes the air cold between the butter and the pan.

—The Revere House, Chicago, has recently put in extensive cooling rooms, built by the McCray Refrigerator and Cold Storage Co. There is one large room in the basement, as well as a large pantry cooler, but the main cooler is in the kitchen of the hotel.

ICY ITEMS.

——The ice factory at Demopolis, Ala., has shut down for the season.

——The ice cutters and handlers of Detroit, are organizing a trade union.

——The Ventura (Cal.) ice factory will open a branch office at Santa Barbara.

——The Hurd Refrigerator Co., at Duluth, has begun manufacturing refrigerators.

——The Decatur, Ala., Ice Co. have spent $30,000 on the improvements just finished.

——J. B. Clough has purchased A. G. Kingsbury's ice factory at Deland, Fla., for $14,350.

——Howard Hall, at Rockford, Ill., has sold his interest in the City Ice Co., to F. S. Sovereign.

——It is rumored that the Cumminsville (Ohio) Artificial Ice Machine Co. is about to change hands.

——The ice factory at Pomona, Cal., expects to run all winter. It is making seventy tons per week.

——The ice makers and dealers at Portland, Ore. (east side) are said to have effected an organization.

——The Central Ice Co., of Chattanooga, are about to erect a fine new stable for their horses and rolling stock.

——The Alabama Ice and Cold Storage plant, in Birmingham, Ala., has been sold to T. W. Hildrop, for $10,000.

——A Birmingham, Ala., paper says that ice is cheaper in that city than in any city of its size in the United States.

——The McCray Refrigerator and Cold Storage Co. are nearly ready to occupy their new building at Kendallville, Ind.

——The Barrett Ice Co., of Huntsville, Tex., has been sold to Staley & Swanger, who will overhaul and enlarge the plant.

——C. E. Sovereign has been elected president of the City Ice Co., Rockford, Ill., and Fred J. Sovereign secretary and treasurer.

——The Danville, Ky., Ice Co. has contracted with a Cincinnati firm to sink a 500-foot artesian well to supply the factory with water.

——The Titusville Ice Co. are unable to meet the full demand for ice, and fish houses are buying ice as far north as at Macon, Ga.

——Augustus Stouffer, an old employe of the firm, has been promoted to be superintendent of J. S. Sible's ice business at Harrisburg, Pa.

——The Alaska Refrigerator Co., Muskegon, Mich., have begun operations on their new factory, said to be the largest of the kind in the world.

——An extensive addition is being built to the De La Vergne Refrigerator Machine Manufacturing Works at Port Morris, to be used as a machine shop.

——A Gloucester (Mass.) fishing schooner recently went to Bangor, Me., to lay in ice, the price being $2 per ton, while at Gloucester the ice men asked $2.40.

——John Humbert and Joel Baughman, of Topeka, Kan., have both been convicted of selling impure ice. Both men cut their ice in Shunganunga creek, and have been selling it for all purposes for several years.

——The Frick Co. are building a machine to cost $198,000, to go to St. Louis. It will weigh 1,000 tons, and will require eighty cars for its shipment from Waynesboro, Pa.—said to be the largest single manifest ever made out by any railroad office in the Cumberland valley.

——An ordinance has been introduced in the town council of Duluth, Minn., regulating the storage and sale of ice for domestic use. It provides that no ice shall be taken less than 1,000 feet from shore. Any person must first secure a permit from the health officer, whose duty it shall be to see that the ice is wholesome and properly stored.

——The Dallas Dressed Beef Co., who started a packing house in Dallas, Tex., last year, have been doing so good a business that they have decided to enlarge their capacity. The equipment of their last year's plant was placed in the hands of the Hercules Iron Works, of Chicago, who supplied the ice machine and piping for the buildings. The company has just given an order for an additional Hercules ice machine, which will manufacture twenty-five tons of ice daily. This will be in place ready for the winter's work.

——At the last meeting of the stockholders of the Western Ice Machine Co., the following officers were elected: Otto Hoffmann, president and treasurer, and Fr. Keller, secretary. The company has built new and very expensive works at Chicago Heights, Ill., equipped with the best machinery, and tools and lighted with electricity. The Western ice machine is gaining ground rapidly, and some very nice contracts are in the hands of the firm already for this season; among them a 50-ton machine for the South Chicago Brewing Co., South Chicago, Ill., which is their second order, as the company has a 25-ton Western running already. The new catalogue of the firm is very handsome (illustrated), and will be sent upon request.



THE NATURAL ICE TRADE.

The season of 1891 has now practically closed, and it cannot be said to have reached a *finale* like that of the play, where everything turns out right, when everybody is made happy and the curtain goes down in a "halo of glory," with colored lights. From all over the North the testimony comes with the almost unvaried burthen of complaint that the season has been an unprofitable one.

In the West the selling season had been preceded by a third consecutive open winter; nevertheless, in spite of the fact that there was less first-class ice in store than the average, dealers opened the season with about a 50-per-cent reduction of prices from the previous year, and made contracts on that basis not only for the summer of 1891, but for one, two and three years in the future, as was frequently the case in Chicago. The only hope for reasonable profit in such trading must have been based on the expectation of liberal sales; but this expectation was in large measure disappointed by the unusually cool weather, lasting until August, when for a short time a genuine summer heat was felt. September's heat made up in part for the mild weather previous to August 1; but on the whole, the season was a short one. While, therefore, stocks have been largely reduced, the profits, after paying cost of handling, have been reduced to the minimum, and holders made somewhat "uneasy," as may be imagined, when ice in September was offered at $1 to $1.15 in the cars at Chicago.

At St. Louis the season opened at $4 (the former price having been $8 and $10) for ice that cost little if any less than $2 laid in the storehouse, or $2.30 for East St. Louis ice on board cars in St. Louis, while some of the supplies came from Rock Island, from up-river towns and from Wisconsin, with freights by rail at $2 to $2.50 per ton to St. Louis. Yet at no time did ice sell for above $5.50 during the season. The dealer needs no suggestions to estimate the profits possible under such conditions, though ice in Wisconsin, f. o. b. and well packed, was offered freely at $1. Both the natural ice dealers and the smaller ice factories accuse the large ice factories with having demoralized the trade by cutting prices in order to "shut them out." This, however, is promptly denied by the heads of the larger firms. Mr. Loomis, of the firm of Huse & Loomis, ice manufacturers, upon being questioned upon the subject, said: "We are now selling ice for 25 cents per hundred or $5 per ton, the same rates that we have had all summer. We put the rates down to those figures to shut out out-of-town competition, and not to hurt the smaller dealers of our city. There is good money in the business at those prices, and I think that every ice concern in St. Louis that has been properly managed has made money this season. There was a concern in Illinois that proposed to ship ice to St. Louis and sell it for less money than the St. Louis manufacturers could afford to

furnish it at. They made one shipment, but that was all. They got 'enough in one round.'" Mr. Robert Bauer, of the Griesedieck Artificial Ice Co., said, "ice had been a little scarce for September, on account of the unusually warm weather for so late in the season, and a greater consumption of manufactured ice than ever before has followed. There are not factories enough in St. Louis to supply the people with it, judging by the way they have been using it for the past two months," added Mr. Bauer. "There are only six factories in the city at present, but more will be built. In the season of 1890, ice sold in St. Louis for $20 per ton. The beginning of the present season it was reduced to $10, and later to $4.50, but we could not make a living at the latter figure, consequently we raised the price to $5 per ton, where we intend to keep it, if we can."

On the Kennebec stocks have been reduced to the lowest ebb, there having been but about 200,000 tons in store September 1, which supply has been further reduced by liberal shipments during the past month, so that only about 75,000 still remain in store. There has been, of course, some growling about low prices, yet the general activity in the way of repairs and building to increase storing capacity would seem to indicate that the season has on the whole been profitable. Indeed, the Kennebec country seems to have done better than any of the great fields this summer, in spite of the reduced prices made in the cities where the cut is consumed, and demonstrated its ability to successfully compete there with the manufactured article.

As to the Penobscot country, the Bangor, Me., *Commercial*, September 30, says: "The ice trade along the river is about over, as far as this season is concerned, and while it has been far from satisfactory to the operators, they are congratulating themselves that it was no worse. There is more or less shipping now, but the dealers do not expect to make many more sales unless the present spell of warm weather should hold. In that event trade ought to have a boom. The prevailing price of ice is now 75 cents per ton, which is considerably more than a losing thing for the most of the dealers, for they say that they get a new dollar for an old one. More houses have been cleared this summer, however, than was expected from the outlook in the spring."

NATURAL ICE NEWS.

——A Chicago man is going to build an ice house at Lincoln, Ill.

——Capt. D. S. Sheppard will build a 400-ton ice house at Pekin, Ill.

——Thorndike & Dix will build an ice house at Rockport, Me.

——Madison, Wis., in September, sent 9,800 tons of ice to Milwaukee.

——H. Puterbaugh's new ice house at Mackinaw, Ill., is almost completed.

——B. Cone, Elkhart, Ind., will rebuild his ice house to enlarge its capacity.

——Another large ice house is being constructed on the lake at Richfield Springs, New York.

——The Western Ice Co., Hastings, Neb., will soon begin the erection of a large ice house in that city.

——Repairs of Maine ice houses are being rapidly closed up, and all indications point to a very busy cutting season.

——The Holyoke and South Hadley Falls Ice Co., of Holyoke, Mass., will rebuild its recently burned ice house.

——Ice houses with capacity for 50,000 tons are being built on the shores of Lake Potanpo, Brookline, near Nashua, N. H.

——Earl Carpenter & Sons are rebuilding their ice houses at Northbridge, Mass., which were destroyed by fire last spring.

——L. B. Hartshorn and M. J. Hovey have purchased, and will continue, Joseph Clutier's ice business at St. Johnsbury, Vt.

——Mussina & Reed, of Lock Haven, Pa., have been supplying Williamsport with ice, at the rate of sixty to seventy tons a week.

——The Rockport Ice Co., Rockport, Me., will erect another ice house this fall, and will store every pound possible the coming winter.

——David Wentling and George Alltop, proprietors of the ice houses burned in September, at Armourdale, near Kansas City, will rebuild.

——The ice company at Thorp, Wash., are enlarging their ponds on Yakima river, to increase their cut this winter from 2,000 to 8,000 tons.

——F. W. Loud & McCloud, ice dealers, have sold out to Mr. Shaw, of Weymouth, Mass., who may purchase the business of Mr. Gardner also.

——Geo. A. Clements, superintendent of the Knickerbocker Ice Co., of New York city, died at Lancaster, Pa., October 13, of Bright's disease.

——Capt. J. E. Lombard, of the Portland Ice Co., is erecting a second 6,000-ton ice house at Hood River, Ore., and will erect another at Celilo.

——Hastings & Co., Troy, N. Y., are building at Albia a new ice house, to hold 15,000 tons, and have three other houses holding 1,000 tons each.

——The ice supply of Rutland, Vt., ran short for local consumption about October 1, the country towns having purchased more liberally than usual.

——J. G. Merrill and J. R. Whipple, the latter from Boston, will build three new houses this fall at Wakefield, Mass., to have capacity for 7,000 to 8,000 tons.

——The Wilson Coal and Ice Co., of Atlantic City, N. J., recently erected at Atsion an ice house, to hold 20,000 tons. Business this season has been excellent.

——Four ice houses near "Shanty Pond," Lawrence, Mass., property of the Lawrence Ice Co., after fourteen years of usefulness, have been torn down to be replaced by new houses.

——At a recent meeting of the Park City (Utah) Ice Co. it was decided to increase the stock from 1,000 to 2,000 shares, and also to increase the storage capacity during the coming winter.

——Shipments of ice from Madison, Wis., were large all through September and earlier part of October, the Knickerbocker Co., of Chicago, taking fifty car loads daily during the last week of September. The same week Hoven, Morgan & Behrends got off 9,000 tons, while a St. Louis firm also shipped a large quantity.

——Baley & Leonard, Rockford, Ill., have purchased a 10-acre tract of land on Rock river, north of the city, on which they will erect new ice houses. Their cut will then be made above the city, where the water is known to be free from sewage contamination, and will float the ice to the city in the summer on barges, loading ice wagons direct from the boats.

——Bangor, Me., *News:* "The schooner Lydia M. Deering, September 30, is loading at the houses of the American Ice Co. for that company's Washington houses. She will take about 2,000 tons. This, with 3,000 tons, which will go to Baltimore, and 2,000 to Philadelphia, together with a small quantity to ship to headquarters at Washington, will clear out all the houses of the company, which have a capacity for 43,000 tons, and were filled last winter."

PACKING HOUSE NOTES.

——The Silberhorn Packing Co., of Sioux City, Ia., has begun to slaughter hogs.

——The Iowa Packing Co., of Clinton, Ia., will get the Sabula house ready for operation at once.

——The Swift Packing Co. will open a branch house at St. Joseph, Mo., and will erect a cold storage house for dressed meats.

——John Morrell & Co., at Ottumwa, Ia., are putting in a 150-ton Weisel & Vilter Manufacturing Co. refrigerating machine, brine system.

——Joseph Stendle has bought four and a half acres of ground on which to build a packing house at Paris, Ill., to be ready by November 1.

——The Cudahy Bros., packers, have purchased land at Buckhorn, near Milwaukee, where new stock yards will be located, and where the Cudahys will build an immense packing house.

——There is a great demand all over the Canadian maritime provinces for sheep for the Boston market. Several car loads passed through St. John on one day for Boston. One Beauce firm recently forwarded a shipment of 1,700 animals, and contracted to deliver 6,000 more before the end of the season.

——The plans for the buildings and other improvements on the new stock yards at Stickney (Chicago), are being rapidly completed, and the actual work will begin, General Manager Washburn said, very soon. It is the intention to push the work during the winter, and unless the weather is too severe all fences and pens will be completed early in the spring.



RAILWAY REFRIGERATION.

A STUDY OF REFRIGERATOR CARS—TWO WELL KNOWN SYSTEMS DESCRIBED—THE PRINCIPLES APPLIED BY TIFFANY.

Our descriptions of refrigerator cars for this month include two well known systems, or patents—the Wickes and the Tiffany—both of which have met with much success and are largely in use by railway and refrigerator line companies. They differ widely in construction and design, and in some respects the principles on which they are built are almost diametrically opposite to each other. These differences may, perhaps, be best indicated by briefly stating the principles dwelt upon by Mr. Tiffany in designing his car, to wit:

(1.) The temperature of the car should never be reduced lower than is necessary to preserve the articles stored therein for transportation, the reason given being that an article which may be preserved at, say, 45° would be injured by a temperature of, say, 38°, and would decay rapidly when exposed to the average summer heat.

(2.) The ice must be placed above the articles to be preserved, the latter being immersed in chilled air by gravitation only, which is always present, and for which no mechanical device can safely be substituted.

(3.) Moderate ventilation, supplying clean, fresh air, should be provided—live, moving air being preferable to confined air for the preservation of meat, etc.

As will be seen below, Mr. James H. Wickes (189,001, March 27, 1877) rejects, or at least ignores, these principles, certainly the last two. He places his ice tank at one end of his car, next to the provision chamber of the car. At the other end of the car, he provides a narrow air chamber, with an opening from the provision chamber at the top, under the ceiling. This air space extends across the full width of the car, down the end and under the floor to a fan blower in the center. This fan is operated by a power attachment to the axle of the car (in motion, or it may be operated by hand when the car is not in motion), and when in motion the fan sucks the air from the provision chamber through the air space; and when the air passes the fan it is forced into the ice tank, through the ice, whence it escapes at the bottom, distributed across the full width of the car into the provision chamber. The inventor also provides for the stoppage of the fan while the car is in motion, presumably when the desired temperature is attained. One of the claims of the patentee is for the automatic float valve for the removal of the melted water under the ice. As the water accumulates, the valve is buoyed up and the surplus water escapes without admitting the air; and whenever the car passes around a curve so as to depress that side of the car where the valve is, there is a rush of water to it, suddenly raising the valve and discharging the water with force enough to carry off the sawdust, etc., which might clog the escape pipe. The valve, being also inside the car, cannot freeze or have a different temperature from that of the car itself. The inventor, therefore, makes provision for the movement of air within the car, but none for admitting the outside air, and relies on a mechanical device for the distribution of cold air through the car—a construction which differs from the Armour car (see September number) mainly in forcing a movement of the confined air.

Mr. Joel Tiffany (193,357, July 24, 1877), on the contrary, provides for the distribution of cold by gravitation, and for ventilation by admitting outside air and removing the air from within the car proper, thus applying all of the principles above quoted as essential elements of a perfect car, and rejecting the fan blower by substituting what he styles a "wind sail." His claims cover insulation, by dead air and packed spaces, the former convertible to live air passages at will; ventilation and cooling. The ice tank is located in a clear-story raised above the roof, the tank filled from the top. The tank is of galvanized iron, the under surface of which forms the roof of the provision chamber. The car proper is inclosed in a jacket composed of horizontal air passages, surrounding it on all sides, the same insulation protecting the ice tank also. These passages have openings at the ends (at the corners) of the car, which may be closed with stoppers, thus making this air space a dead or live air passage, as desired. When open, a circulation of air completely surrounds the provision chamber, which has the effect of cooling the car in summer, and in winter, when the openings are closed, acts as a protection against cold. The provision chamber and this air space are connected by tubes in the ceiling, which permit the escape of the foul air from the provision chamber to the air space, and thence outside the car itself by the end openings. At each end of the clear-story containing the ice tank is an opening for the outside air to enter what is called a "wind sail"—provided with a valve and shutter to regulate the

quantity of air admitted—the air passing down into the car through pipes to the water tank containing the melted ice. A wire gauze screen (seventy meshes to the inch) keeps out all cinders, while the water upon which the air is forced, takes up the dust. It is then carried up by pipes to the ice tank, the ice resting directly on the pipes, and then distributed when cool through the car by smaller pipes running lengthwise, which serve as hangers for meat hooks, etc., thus completing the air circulation, and by entirely automatic methods.

Thus, it will be seen, here are two cars built on radically different principles, yet in practice both have been eminently successful, and are to-day among the best known refrigerator cars now running. How much the advantages of capital and push are responsible for this latter fact it is not necessary to say; but from the study of them one cannot escape recognition of the fact expressed in the homely proverb of the countryman, who says, "there is more than one way to skin a rabbit," and proves it in practice.

This exposition of the principles on which these two cars are built, it is proper to add, is based on the original patents, issued in 1877 : and that both systems have been since much modified and perfected, bringing them fully abreast of the most modern requirements; and that in a future issue ICE AND REFRIGERATION will give detailed descriptions of those modifications and improvements.

MR. SNEATH, of the Consumers' Ice Co., San Francisco, recently entered a complaint with the state board of railroad commissioners against the Southern Pacific R. R. Co., relative to the high rates on ice. "The railroad people denied, in a long answer to Mr. Sneath's complaint, that its rates of transportation were prohibitory of an enormous demand on the local companies for ice for use in the warm valleys of the state or elsewhere, or that such demand exists, or would exist were it not for the transportation company's present rates on the cold commodity," says a Frisco paper. "It denies that its schedule rates are ten times the rates of roads leading from the great lakes in the east to various interior points, or at all in excess of such rates, after making proper allowance for the additional cost of service to the defendant over the cost of similar service in the east. It avers that its rates are reasonable and just." One cannot but admire Mr. Sneath's nerve in taking this kind of a bull by the horns; but from all accounts that come east of the character of the railway monopoly of California, we cannot undertake to congratulate him in advance on his victory over the "grasping," etc.

THE "latest" comes from Maine, and as Maine has been a prohibition state for some forty years, it is perhaps safe to repeat the story, for which the Brunswick, Me., *Telegraph* is said to be responsible, and which is to this effect: "One day recently while a citizen of Brunswick was breaking ice for his table he noticed a speck in the middle of the cake. Cutting down near to it he saw it was a small toad. He cut the animal out and laid it on the table to thaw out. When the ice melted he put the toad in a box, carrying it down cellar. Late that afternoon he opened the box and was somewhat startled to see the toad jump out."

FOREIGN NEWS ITEMS.

——Freezing chambers have now been established in the market at Madrid for the preservation of meat and game.

——According to recent reports there are openings in Italy for ice making machinery to supply ice for domestic uses.

——The French consul at Vigo, Spain, says: "Vigo possesses only two steam power refrigerators for making ice used in packing fresh fish for railway transport. A third ice factory is now in course of erection."

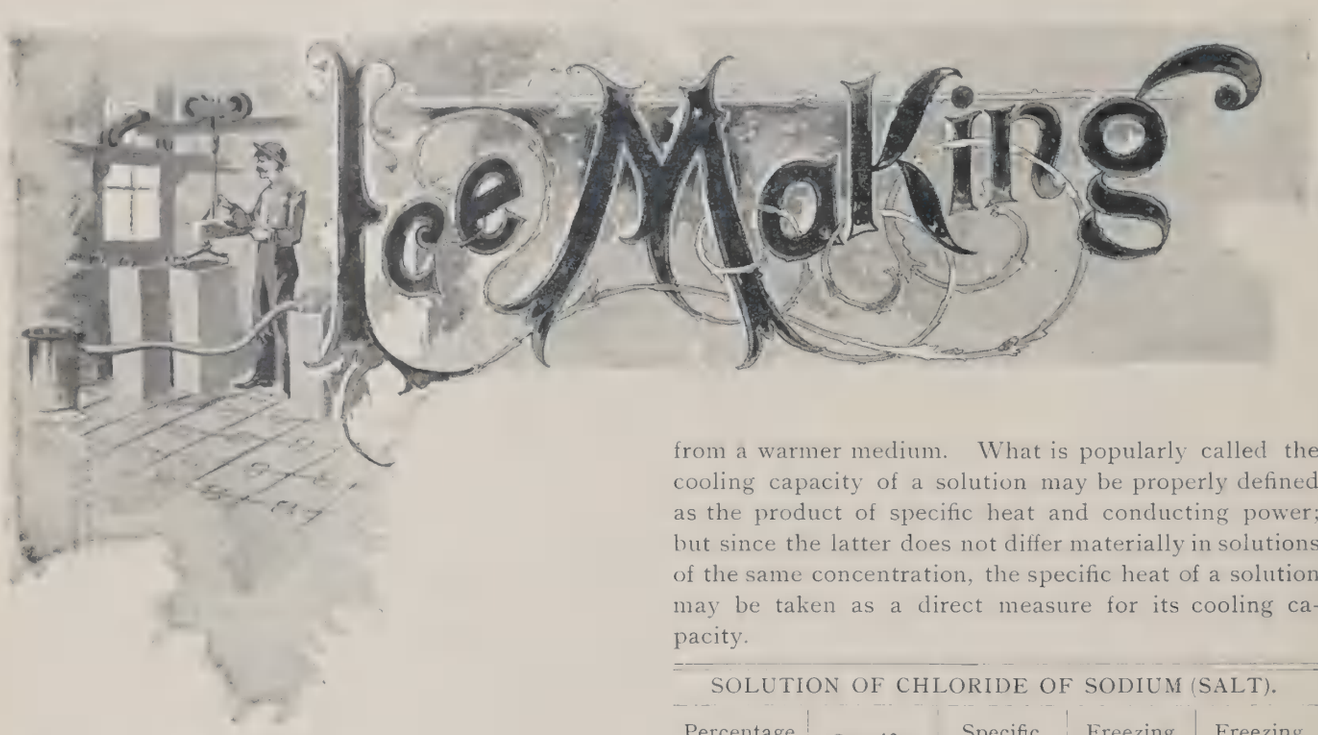
——The Dutch consul at Bangkok, Siam, writes: "There are two ice factories here; one belongs to a Danish firm (Messrs. Andersen & Co.), while the other is a Siamese venture. Owing to several breakdowns of the machinery, the native company had to provide all the ice wanted, and did a very good business."

——The Dutch consul at Brisbane, Queensland, Australia, says: "The export of frozen meat and preserved meat in tins seems to assume greater dimensions. The Lake's Creek Meat Preserving Works have made various shipments to England during the year. In view of the rapid increase of live stock in the colony, it is of vital importance that surer means for the safe export of frozen meat should be adopted."

——A Paris telegram, October 23, says: "The opposition of the agricultural class to the admission of American pork threatens to block the removal of the restrictions by the senate, either directly or indirectly raising the tariff to a figure almost prohibitory. The rejection by the cabinet of the senate proposition to raise the duty to twenty-five francs per 100 kilos on salt meats does not end the obstructive fight against the American product, although there is now no pretense that the opposition is actuated by any other motive than a desire to protect the French pig breeders against foreign rivalry."

——The New Zealand Refrigerating Co. held its tenth annual meeting at Invercargill, in August last. The report for the year ending June 30 last shows satisfactory results, a dividend of eight per cent being declared. During the past year 247,784 carcasses of mutton and lamb were frozen and shipped from the company's works, and 7,520 carcasses were slaughtered there and frozen on board the sailing ship *Timaru*, making a total of 255,304 carcasses handled, an increase over last year of 22,971 carcasses. There were also frozen and shipped 55,204 pounds of beef, against 54,947 pounds the last year. From the Oamaru works were shipped 130,862 carcasses, of which 36,900 were lambs, and from Burnside 124,442, of which 18,915 were lambs. The total number of lambs shipped, 55,815, shows an increase of close on 26,000 as compared with last year, but this increase the directors do not regard as entirely satisfactory, either in the interest of growers or of the trade generally. The large number of lambs sent from the colony this season has apparently glutted the London market, and returns have been more or less disappointing in consequence. There is, moreover, reason to fear that the shipment of ewe lambs in such numbers may tend to decrease the export of mutton in the future. The prospects of the company are improved by the chairman's announcement that the shipping companies have agreed to reduce the freight to 1d. per pound for equal shipments throughout the year, the reduction to take effect from the 1st of December next. With reduced charges there and in London, and with this concession in freight, there seems to be every prospect during the ensuing season of favorable returns to growers, and an increased output from the company's works.

——Some railroad men in Australia prevailed upon the officials in charge of the railroads there to import some Wickes refrigerator cars from America, under the impression that they would be useful in the transportation of fruit and dairy produce in that warm climate. The enterprise does not appear to have been appreciated by those who will no doubt eventually be benefited by the use of the cars, for we find the following attack in a Melbourne paper: "The absurd blunder committed by the railway authorities in building costly and wholly unsuitable refrigerating cars, with a carrying capacity of twenty tons, instead of constructing light running cars, capable of carrying about four to six tons of dairy produce, was brought before the legislative assembly yesterday, when a return called for by Mr. Armytage was presented. As has been pointed out in these columns, the commissioners actually ordered the wagons to be built on the pattern of an American meat carrying car, used for traveling long distances in the United States, and the vehicles, as may easily be comprehended, are quite unfitted for the carriage of dairy produce, which has to be picked up in small parcels at different stations. The return shows that thirty-one cars have been built. The cost of each was £602 4s. 5d., exclusive of items supplied to contractors free of cost—namely, wheels and axles, channel bars, buffers, bearings and Westinghouse brake fittings, which bring the total cost up to £772 10s. 6d. The weight ranges from seventeen tons sixteen hundredweight to eighteen tons. The approximate cost of maintaining a temperature of 50°, 60° and 40°, respectively, inside the cars for nine hours continuously, the temperature outside being eighty degrees, when in actual constant traffic equals £7 per ton for each car per week (equal to 7s. 6½d. for nine hours), ice being supplied at 70s. per ton. Experiments have not been made with fixed internal and external temperature, nor with the internal temperature at 40° and an external temperature of 80°. The name of the patent used is that known in the United States as the 'Wickes.'"—*National Car and Locomotive Builder.*



[*Written for* ICE AND REFRIGERATION.]

THE PREPARATION OF BRINE.

THE COOLING PROPERTIES OF BRINE, OR SALT, SOLUTIONS—SPECIFIC HEAT OF SOLUTIONS COMPARED—THE BEST CONCENTRATION OF SALT SOLUTIONS.

BY PROF. J. E. SIEBEL, DIRECTOR OF THE ZYMOTECHNIC INSTITUTE, CHICAGO.

In the successful operations of refrigerating machinery, as well as in all other operations, many things are brought into play, which at first sight seem to be of little importance, yet which amount to a great deal, if considered in connection with the large plants now devoted to storage purposes and refrigeration in general.

Among the questions which present themselves on this subject, the one relating to the composition of the refrigerating vehicle which is used in connection with the machines with indirect refrigeration, is of considerable interest. Generally salt brine is used for this purpose, but other solutions, notably that of chloride of calcium, have been recommended, and to some extent have been used for this purpose. Several advantages have been claimed for the solution of chloride of calcium, among others that it would do more cooling, or cool quicker, and that it would be less severe on iron pipe. From experiment, however, which we were able to make, the latter claim is without foundation in fact, as far as regards pure solutions of both materials; and there is no reason to suppose that the chloride of calcium of commerce is any purer than the chloride of sodium, or common salt,—quite the contrary. The capacity for cooling is also not greater in a solution of chloride of calcium than in a solution of common salt, as will be readily understood by a comparison of the specific heat of the different solutions, as given in the following table.

By specific heat of a substance, or solution, is meant the amount of heat (in thermal units) necessary to elevate the temperature of such substance for one degree. Consequently the greater the specific heat of a refrigerating solution, the larger the amount of heat will be which a given weight of the same is able to withdraw from a warmer medium. What is popularly called the cooling capacity of a solution may be properly defined as the product of specific heat and conducting power; but since the latter does not differ materially in solutions of the same concentration, the specific heat of a solution may be taken as a direct measure for its cooling capacity.

Percentage of salt by weight.	Specific heat.	Specific gravity at 60° F.	Freezing point, degrees F.	Freezing point, degrees C.
SOLUTION OF CHLORIDE OF SODIUM (SALT).				
1	0.992	1.007	31.8	—0
5	0.960	1.037	25.4	—3.6
10	0.892	1.073	18.6	—7.5
15	0.855	1.115	12.2	—11.0
20	0.829	1.150	6.0	—14.4
25	0.783	1.191	1.86	—16.8
SOLUTION OF CHLORIDE OF CALCIUM.				
1	0.996	1.009	31	—0.5
5	0.964	1.043	27.5	—2.5
10	0.896	1.087	22	—5.6
15	0.860	1.134	15	—9.6
20	0.834	1.182	5	—14.8
25	0.790	1.234	8	—22.1

By referring to the foregoing table, we find, therefore, that the relative cooling capacity of a 15 per cent solution of common salt and that of a 15 per cent solution of chloride of calcium are as 855 to 860; that is, as nearly alike for all practical purposes as can possibly be. The same is the case with solutions of other strengths.

Another criterion bearing on the relative preference of solutions of chloride of calcium and of common salt for the above purpose, is the amount of each to depress the freezing point of the solution for a given number of degrees, it being the only object of the use of these substances to obtain vehicles which will not freeze or congeal at the working temperatures of refrigerating machinery. By referring to the above tables we find that the solutions of common salt, between the concentrations of 5 to 15 per cent and over, freeze at a lower temperature than solutions of chloride of calcium of corresponding concentration. And as these concentrations include those mostly used, for our purpose the salt brine must be considered preferable on this head also, except when working at exceptionally low temperatures.

Thus we may take it for granted that as a refrigerating vehicle for machines with indirect cooling, salt brine is at least equally good as solutions of chloride of calcium; it is decidedly preferable, when the price of both is considered—at least in the United States.

This being settled, another question in connection with this subject regards the best concentration of the

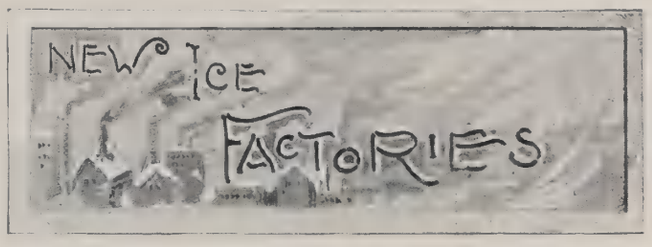
solutions of salt used for the above purpose. This question is also readily answered by the above tables, for we see by them that the specific heat, or the capacity for heat in salt water, is much less than in ordinary water, and that it increases as the solution becomes more diluted. In other words, this means that a certain weight of water, while its temperature raises for a certain number of degrees, will abstract more heat than an equal weight of brine if raised for the same number of degrees, and that as a vehicle for transmitting cold 0.8 pound of water will do the same service as one pound of brine of 1.186 specific gravity; or, if this is reduced to gallons, 7.9 gallons of water will do the same service as 8.33 gallons of brine of the density quoted. In the light of volume measurement, the difference in the service done by the two media is not so great, but still great enough to demonstrate that it is poor policy to make solutions of salt for refrigerating purposes any stronger than is necessary to keep them from freezing. By observing this rule the proper concentration of salt brine in individual cases can be readily found from the above table. Thus if in a certain case the brine leaves the refrigerating tank at a temperature never below 15° F., it would be irrational to use a solution containing more than 15 per cent of salt; and if the temperature of the outgoing brine is never below 20° F., the brine need not contain over 10 per cent of salt. In both cases, the brine will be sufficiently strong to be prevented from freezing, which is all that is required in this respect.

There is another and very practical reason which should prevent the use of too strong, especially of concentrated, solutions of salt for refrigerating purposes. Such brine being subjected to lower temperature in the refrigerator, would have a tendency to deposit salt in the pipes which may, nay, in fact, has already given great trouble in a case which has come to our knowledge. For this reason a brine should never contain more than 24.3 per cent of salt, this being as much as will be held in solution at 0° F. A solution of this kind has a specific gravity of 1.186, and in every gallon of it, which weighs 9.88 pounds, is contained 2.41 pounds of salt.

As is well known, the capacity of refrigerating machinery is frequently estimated by calculating the amount of calorics abstracted from a given amount of brine in a certain time. In such cases, the concentration of the brine must be taken into consideration on account of the differences in specific heat of brines of different strength, as is also shown by the above tables.

THE *Express*, at Bellingham Bay, Wash., says that the ice manufacturing company of that place is freezing about 800 salmon per day, to be shipped to the New York and Chicago markets. As the mouth of the Nooksack river is a great fishing ground, the establishment of the ice factory has developed a new business. Part of the fish are taken by steamer to the Blaine cannery, and the balance are prepared for market there.

PROBABLY the largest creamery in the world is that at St. Albans, Vt. The building itself is three stories high, with 9,000 feet of floor room. About 700 farmers, with 12,000 cows, are now supplying the cream for the factory, and the average daily product is 10,000 pounds.



Ice factory construction in the South has been on a much more conservative scale in 1891 than in 1890, and wisely so, as in some parts of the South the ice making business was more or less overdone. It cannot be said that the South is oversupplied with factories, but rather that the building has been affected by the somewhat injudicious selection of locations for new factories. Because one factory in a given city is successful, it by no means follows that two factories in the same city will be equally successful; yet a great deal of building last year (1890) was on that basis or assumption. In 1891, therefore, warned by the self-evident, growing demoralization of the business through lack of care in selecting localities for new plants, the number of new factories has been greatly reduced; in the quarter ending October 1, 1891, for example, the number of new factories reported from the South being but sixteen, as against fifty-five for the same quarter in 1890, and fourteen in 1889, the total for the nine months of 1891 being fifty-eight. This is a very material falling off, in construction, but it indicates a much healthier condition than existed in 1890, since factories now are being put up only at points where there is an actual demand for the product, and where there is a reasonable expectation of earning dividends on the investments. Machinery and supply men will also be benefited by the break in the "boom," by giving the business greater stability and reliability, and what may apparently be lost of business South will be fully made up by increased activity in the North, both in ice making and refrigerating machinery, so that the outlook now is excellent for a busy construction season. Many manufacturers of machinery report that good *bona fide* inquiries for new plants and enlargements are plentier than ever, from men of the very best class—men with money, who mean business.

Our list of new works this month shows a fair activity in the way of new companies and enlargements, which will hereafter increase in number, without doubt. Our great crops, north and south, east and west, to be sold at good prices, in view of the shortage abroad, promise a season of prosperous business in all lines of trade and production, which will, of course, be felt in the ice business, as in other industries.

NEW FACTORIES AND IMPROVEMENTS.

ALABAMA.

Decatur—The Decatur Ice Co. have completed their improvements, at a cost of $30,000; capacity, thirteen tons daily.

ARIZONA.

Phoenix—S. D. Lount & Sons will enlarge their ice factory to three times its present capacity.

ARKANSAS.

Arkansas City—Samuel Marks is said to be in the market for a 10 or-15-ton ice machine.

Morrillton—An ice factory is soon to be established.

Pine Bluff—J. P. Angel & Co. will build a 15-ton ice factory and cold storage plant.

CALIFORNIA.

Bronco—Work on the ice factory is progressing rapidly.

Riverside—An ice making plant of 15-ton capacity is now being erected by the Fulton Engine Works, of Los Angeles, Cal., to be run by water power.

FLORIDA.

Lakeland—Pierce McCrary, representing Atlanta people, will build an ice factory.

Ocala—The East Florida Ice Manufacturing Co. will put in a 15-ton machine during the winter.

GEORGIA.

Augusta—An ice factory is to be erected at North Augusta.

Augusta—J. W. Jackson, of the North Augusta Land Co., can give information of a $100,000 brewery and ice factory to be erected.

Fort Valley—Arrangements are being made by G. H. Holgate, S. T. McNeil and others to build an ice factory.

Marietta—W. Young, Cortland, N. Y., S. C. Phillips and others have incorporated the Marietta Water Works Co.; capital, $100,000. They will erect an ice factory.

KANSAS.

Leavenworth—Business has resumed at the Ryan & Son ice factory, the legal difficulties between the owners and the makers of the machine having been adjusted.

Pittsburg—C. H. Boaz & Bro. have purchased a 20-ton "Southern" ice machine, to be finished by January 1, 1892.

KENTUCKY.

Winchester—J. P. Cassidy has started an ice factory.

LOUISIANA.

Algiers—At a meeting of the Algiers Ice Manufacturing Co. at New Orleans, Peter Blaise was elected president; Wm. Wenzel, vice-president; Geo. D. Hite, secretary and treasurer; F. Strenby, manager. John W. Webert will make the plans, and the work of building will be pushed rapidly.

Baton Rouge—The Louisiana Ice and Cold Storage Co. will double the capacity of their plant this winter.

Lake Providence—The Lake Providence Ice Manufacturing Co. has been incorporated by John Williams and others.

New Orleans—The People's Slaughter House and Refrigerator Co. has been incorporated.

New Orleans—Hart & McDonald have contracted for three 50 ton "Southern" ice machines to be erected by February 1, 1892.

MISSISSIPPI.

Grenada—The ice factory, R. Dock, president, has recently commenced operations.

Scranton—The Pascagoula Ice Co. will erect a 10-ton ice factory. They have purchased a "Southern" machine, to be erected by December 1, 1891.

Winona—The Southern Ice and Cold Storage Co. has just finished an ice factory.

Yazoo City—An effort is being made to organize a company to build an ice factory.

MISSOURI.

Charleston—Frand Hequembourg and others, of Poplar Bluff, will build an ice factory. They have purchased a site.

St. Joseph—W. L. Distin is canvassing the project of erecting an ice factory and cold storage plant.

NEW YORK.

New York—The new Hotel Savoy, Broadway and Twenty-ninth street, to be opened February 1, will contain a Frick refrigerating machine for cooling the building and the steward's storehouse.

NORTH CAROLINA.

New Berne—The ice company has ordered a 12-ton machine of the York Co., to be set up and in operation by February 10, 1892. This will give the company an 8-ton and a 13-ton machines, with 180-horse power of boilers.

Washington—C. H. Sterling will put in a duplicate of his 5-ton machine, to be erected by the York Manufacturing Co.

NEW JERSEY.

Paterson—The Diamond and the Artesian Well Ice companies have consolidated, and will erect an extensive ice factory.

Plainfield—J. F. McDonald and J. A. Smith are looking for an ice plant of fifteen or twenty tons.

OKLAHOMA.

Oklahoma City—Williams & Watson will erect a 10-ton ice factory. They have purchased a "Southern" machine, to be running by March 1, 1892.

OHIO.

Youngstown—The Crystal Ice Co. has been incorporated; capital, $30,000; a committee of stockholders will select the machinery to be purchased.

OREGON.

Eugene—The new ice factory began making ice about October 1.

PENNSYLVANIA.

Collegeville—The Collegeville Ice Co. will at once rebuild the factory recently burned, the plant to be completed by December 1. The machine will be made by Geo. F. Ott, of Philadelphia; capacity, ten tons.

SOUTH CAROLINA.

Savannah—The De La Vergne Refrigerating Machine Co.'s 60-ton ice works on Indiana street, are progressing rapidly. A 10-inch artesian well has been begun. The works will be finished by December 1.

TENNESSEE.

Bristol—The Diamond Ice Co. and J. W. Waynich's bottling house will be consolidated, the new company to build a brewery.

TEXAS.

Abilene—C. M. Dollis will build a 10 or 15-ton ice factory.

Cameron—S. Wohlich will increase the capacity of his ice factory.

Paris—A. P. Park, W. H. Ragland and H. H. Kirkpatrick have incorporated the Southern Produce and Trading Co., to construct, own and operate refrigerator cars; capital, $25,000.

Velasco—Hugh Hamilton, of Houston, has contracted with the Brazos syndicate to put up an ice factory and cold storage house, the syndicate donating a block of land.

VIRGINIA.

Norfolk—The Hygeia Ice Co. are now setting up their second 50-ton machine, which will be followed by a third, to be set up before next spring. All these are built by the Columbus Iron Works Co.

WASHINGTON.

Olympia—Work has begun on the erection of an ice factory.

Spokane—W. E. Rockwell, of the Union Ice Co., of Seattle, is working up the project of constructing here an ice making plant of 250 tons capacity.

Tacoma—The Union Ice Co. have purchased new engines for their Tacoma and Seattle factories.

Tumwater—The Tumwater Ice Co. has been incorporated; capital, $15,000.

TRADE CORRESPONDENCE.

[The publishers of ICE AND REFRIGERATION do not hold themselves responsible for the opinions expressed by correspondents on any topic; but these columns are at all times open for the discussion of subjects of interest to the trade. Our readers are cordially invited to contribute to this department by giving their views on questions propounded, or by suggesting original topics for trade discussion. Anonymous letters will receive no attention whatever.—ED.]

BUFFALO, N. Y., October 1, 1891.

To the Editor:

The co-partnership hitherto existing between W. A. Case, W. G. Case, J. F. Behn and Carl Behn, under the name of the Buffalo Refrigerating Machine Co., has expired by limitation this day. Whitney G. Case will settle the financial affairs of the old company.

We beg to announce that W. A. Case and W. G. Case have associated with them Mr. G. A. Wegner, the inventor and designer of the machine which was introduced by the old company about three years ago, and which has been built by them up to date. The manufacturing of ice machines and construction of refrigerating apparatus of every description will be continued under the name of "The Case Refrigerating Machine Co.," and we will continue to build the same style machines as heretofore, and will add thereto many important improvements, thus keeping apace with the times, and fulfilling our promise to keep ahead of all competitors.

In making estimates we will always endeavor to make them as low as first-class material and workmanship, which is so essential in ice and refrigerating plants, will allow.

If you intend investing in any ice or refrigerating apparatus or machinery, you will find it to your interest to obtain our figures, which will be furnished promptly and cheerfully. Send for our descriptive catalogue.

THE CASE REFRIGERATING MACHINE CO.

BUFFALO, N. Y., October 1, 1891.

To the Editor:

We beg to announce to you that the partnership between W. A. Case, W. G. Case, J. F. Behn and Carl Behn, comprising the Buffalo Refrigerating Machine Co., has to-day been dissolved by limitation.

Mr. J. F. Behn, who has been the practical head of the concern, and under whose sole direction all the machines have been designed, built and erected, has purchased the name, good will, all drawings, patterns and books, in fact, the entire interest of the said W. A. Case and W. G. Case in the concern, and will, in connection with his son, Carl Behn, continue the business under the present name of the Buffalo Refrigerating Machine Co., at the old stand, corner Ohio and Washington streets, Buffalo, N. Y.

Respectfully yours,

BUFFALO REFRIGERATING MACHINE CO.



[*Written for* ICE AND REFRIGERATION.]

PRACTICAL COLD STORAGE.

THE HANDLING OF POULTRY—THE BEST WAY TO FREEZE AND PACK DRESSED POULTRY—THE FATTENING OF LIVE TURKEYS—THE STORY OF A POULTERER'S EXPERIENCE.

BY D. B. BEEMER.

The handling of this class of goods through cold storage is quite a different matter from carrying eggs. Everybody who possesses a cold storage plant of whatever nature, from the crude butcher box style upward, does not hesitate to load up with eggs and gamble on the chances of making an ultimate profit after standing all possible shrinkage, but these cheap and weak systems are of no account whatever where *poultry* is to be carried.

If poultry is to be frozen up *after* storage, there should be a temperature as low as 10° to 15° above zero in the rooms to do the work properly. *The quicker the freezing is done, and the lower the temperature in which it is done, the better the stock will be when finally put on sale.* The *best* plan is to freeze the stock by *outside* cold when the temperature is about at zero. This admits of packing the poultry in boxes or barrels while comparatively soft and pliant, so that it may be done tightly and save waste of space. It can, in such case, be packed rounding full, and then when partially frozen be settled down by screw power below the line of the lid. When such a compact mass is frozen hard in such low temperature, before heading up in lard tierces or boxes made of matched inch boards, made as nearly air tight as possible, it will, under similar circumstances, carry twice as long as poultry frozen by a slower process in a temperature above 20° F.

After freezing in the manner first described, the packages may be stored as compactly as possible in rooms held at a temperature of 20° to 25° above zero, and carried safely for an indefinite length of time—many months—perhaps *years*. It is dangerous to attempt to freeze up poultry in cold storage rooms in a temperature above 20° above zero, when it is packed tightly in boxes or barrels, even with the covers off. The process of freezing the contents of such a package never varies:—the frost attacks and hardens the contents from the outside—top, bottom and sides simultaneously, and then drives its way in, from all directions, toward the center. This process is more or less slow or rapid, according to the degree of cold in the room. In a temperature above 20° F., it requires several days for the frost to reach the center, and many days more to freeze the contents as hard as 20° F. is capable of freezing it. The *danger* lies in the fact that during the time that it takes the frost to drive to the damp, soft center of the package *this center may sweat and sour*, as it often does under such circumstances. Again, poultry frozen so slowly in the damp, confined air of such rooms is apt to lose its original brightness of color, *lean* birds particularly becoming red or dark colored. When poultry is once properly frozen and headed up in an air tight package, there is a cast iron rule governing it, which can never be trifled with: *The frost must never be allowed to start from the contents while in storage.* If the poultry softens to but the depth of a half inch on the outside, *blue mold will form* and, driving through the entire package, cover and coat each bird *and practically spoil it.* Great loss formerly resulted from this cause on poultry shipped from the far west to eastern markets while in transit, before refrigerator cars came into use.

During the war of secession, with gold at a premium of 250 per cent, more or less, poultry, in common with other farm produce, reached a high range of prices: dressed turkeys, for instance, ranging from twenty-five to thirty cents per pound in Boston and New York. In 1864 I was a speculating young man, doing business at Whitewater, Wis., a town of 3,500 people, on a railroad, fifty miles west of Milwaukee.

A Boston price current, quoting high prices, and giving instructions how to dress for that market, induced me to experiment in the matter. I drove about the country in every direction for ten miles, and contracted for all the surplus turkey crop at a stated price per pound, live weight, delivered to me in town. I was able to secure but about 500 turkeys, on all this ground. I fenced off, with a high picket fence, a feed yard from a portion of a garden lot, erecting a board shed on one side, with a tight garden fence as a back, and the roof slanting down to its top, the front boarded tight upon the supporting front posts, from the front of the roof down to within three feet of the ground, thus leaving an open front into the feed yard. Inside I erected a set of ladder roosts for the turkeys, made a lot of board feed troughs, and waited for deliveries.

I soon had my hands full of the business. As different flocks were turned in together, pitched battles

always occurred between the cocks until supremacies were established properly between them.

They often killed each other on such occasions, if not interfered with. I was forced to spend a good deal of time among them, in consequence, with a black-snake whip, like an old-time southern plantation overseer, and thrash them right and left to make them behave, till they got accustomed to each other. I supposed, too, that having the roost handy and open to use at proper time, they would each and all go to roost readily; but as a matter of fact, but few would go till it began to get dark; then, being all of one mind, they would pack in under the shed, like sheep, and before half of them could work their way up on the roosts, it would get dark, and the balance of them would jam into a packed crowd in the corners, on top of each other, and smother a lot of them to death before morning. Finally I had to drive them all into the shed before sun down, and pen them in, giving them time to get up on the roosts before dark.

Then another difficulty occurred in fattening them. It was necessary that they should all have an early feed in the morning. Left to themselves, however, half the birds would stick to the roosts till noon; so I adopted the plan of going into the roosts at daylight, and with a light pole tip the occupants of the lower roosts off upon the ground, then drive those on the next higher roost down upon the vacated roost, and thence to the ground, and so empty them all in rotation; drive the birds all out into the yard, and pen them out of the roosts all day, and so could rotate the feed through them necessary to fatten them—a feed of hot mush first, in the morning, then clear water, and at noon hot mashed potatoes, followed by gravel and charcoal, broken into small pieces, to "regulate" them; later more water, and, lastly, whole corn before driving into the roost at night.

It was a new business, and there was no one with experience available to learn anything from in connection with it; but I at last got them fat and ready for market. Then arose the question of getting them safely to Boston, which, as the railroads made time then, it would take two or three weeks to do, with no refrigerator cars available, as later on. I finally dressed them off when the weather was about zero, packed them in new lard tierces when the wings and legs began to stiffen with frost, so that I could pack snugly and tightly; then I let the tierces stand open for several days, till contents were frozen as hard as stones, apparently; then heading up the tierces, I had them sealed up in an air tight package, the thick, dense staves of which would be capable of retaining the frost through a protracted thaw, should one overtake them while on the road or in transit. Then I started them for Boston, and gambled on the outcome.

Eventually I got a telegram from the consignees, announcing their safe arrival and sale at 25 cents per pound, and requesting me to forward a car load at once of the same kind of stock; but I had exhausted the crop in that section of the country, while my regular business would not allow me to go elsewhere after more, even if it had not been too late, as it then was, to find live birds in any quantity to dress off for the purpose. So all that I could do was to plan for the next season's business on a larger scale. In the spring I drove about the country and contracted for all the turkeys they could raise upon the old stamping ground from which I had bought the previous season. This stimulated production, and in the fall I got 1,500 turkeys off the same ground, which I handled in same way, at good profit *through the refrigerator tierces.*

(TO BE CONTINUED.)

THE growth during the past few years in the demand for refrigerating and ice making machinery and appliances has far outstripped the expectations of the most sanguine. It is surprising how many industries of widely divergent character are affected by mechanical refrigeration in some way. Perhaps one of the most annoying difficulties the manufacturers of this class of machinery have to contend with is the lack of expert engineering skill and knowledge in the possession of the average engineer and superintendent of construction engaged to erect and start refrigerating machinery after they have been delivered to purchasers. This fact has practically opened up a new field for endeavor and investment. There is a demand from all parts of the country for men possessing a thorough scientific and practical knowledge of ice making and refrigeration in all its branches to superintend the erection and plan alterations and changes in plants. In the interest of the trade generally, we take pleasure in noting the fact that several such men have opened offices and commenced operations in this line in various parts of the country. Among the latest of these is Mr. F. L. Galigher, room 709, Chamber of Commerce building, Chicago. Mr. Galigher has had the benefit of many years' experience in about every capacity in connection with this class of machinery. Much of his time has been spent in the South, where he has been engaged personally in the erection and successful operation of several ice making plants. Some few months since he was called to Chicago to put in running order and manage the plant of the Consumers' Pure Ice Co. His efforts have met with eminent success, and the company very highly commend his services. The plant, now being in perfect running order, Mr. Galigher has decided to sever his connection with the above company and open an office as an expert in this line of work, at the address given.

Harper's Weekly is very much pleased, evidently, at the establishment, near Washington market, New York city, of a central refrigerating plant to supply a current of cold to the stalls of that market, over 300 in number, for the "journal of civilization" says truly: "The only sense in which this is new is that it is done on a larger scale than ever before. It is like applying the principles of the telephone to the long distance telephone. As has been already explained, the idea of refrigerating an ice box or a house is not new. The idea of doing it from a central plant, and supplying minus heat or positive cold through pipes is new. It does away with the handling of ice at each box owned by a customer, and enables the butchers and other dealers in the market to keep their wares as long and as well as if they were packed in ice. In one up-town hotel, where the plan has been in operation for nearly two years, the saving has been found to be over seventy-five per cent of the former cost. It is distinctly one of the great steps forward in modern progress."

——The Chester, Pa., Ice Co. will not be allowed to cut ice this season in the lake of the Ridley Park Land Association, and are now looking for a new site. They may handle eastern ice.

[*Written for* ICE AND REFRIGERATION.]

A COLD STORAGE PLANT.

WHAT COLD STORAGE MEN WANT—A COMPARISON OF TWO COLD STORAGE HOUSES—DESCRIPTION OF A COLD STORAGE HOUSE FOR DRESSED MEAT IN ARKANSAS.

BY "WOODSON."

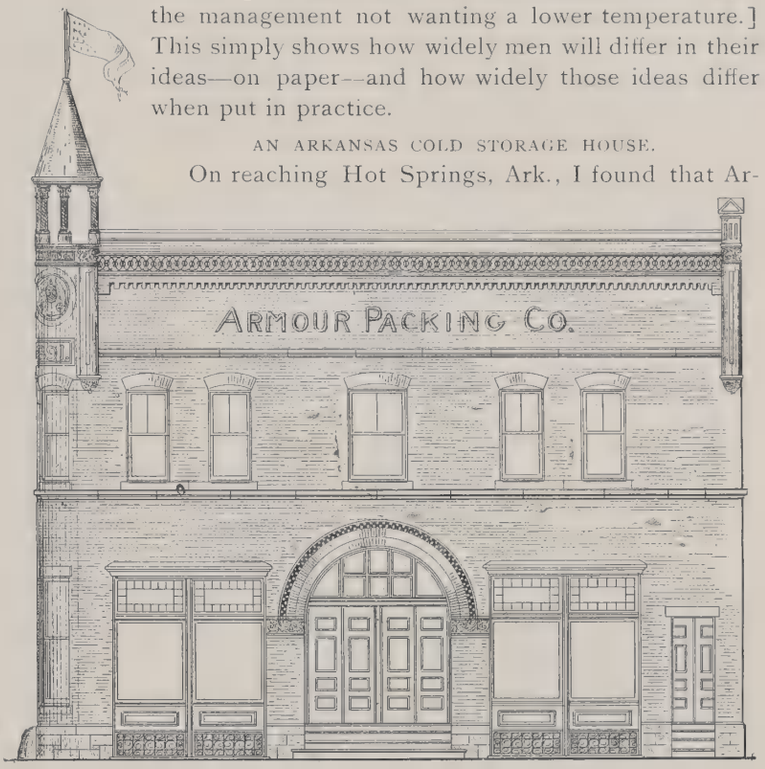


S I HAVE been traveling, it has been my pleasure, during the past year, to visit a great many cold storage houses, and to study them with a view to learning the advantages and disadvantages of the different systems in use. I do not propose to set down any *dictum* as to what I deem the best, though I have my own notion; but I may tell you what I have seen in my travels.

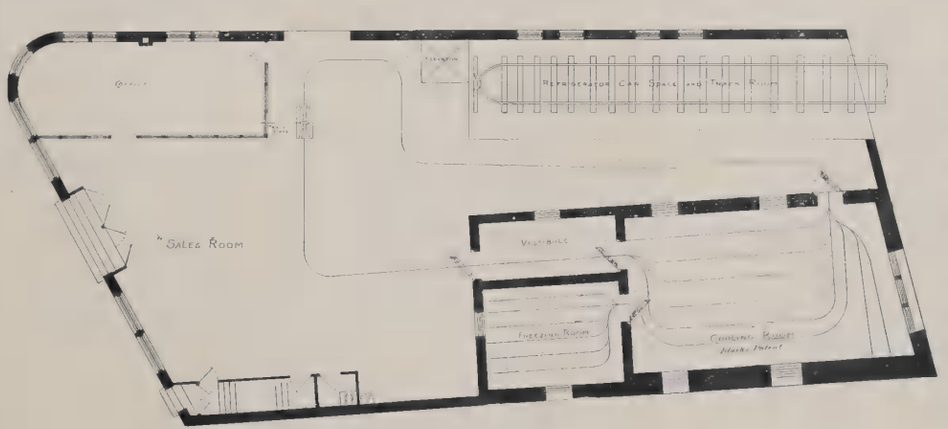
Every one, of course, wants a dry house with good circulation of air, coupled with as little expense as possible, either for ice or cost of operating refrigerating machinery. Many have been very careful in the selection of machines or of the quality of ice to be used for chilling their rooms, but seem to have overlooked pretty much everything else. Now while the points named are essential, it is equally important to have a properly constructed cold storage room, built on scientific principles, with a view to retaining within the walls of the cooler all of the cold air produced, and still have a circulation sufficient to keep the air pure and dry. I never had a better opportunity for contrasting the different systems under exactly the same conditions than recently in a southern city, where I found two houses built at the same time, of about the same size, capacity and exposure, both fronting the same way, and neither sheltered from the sun's rays, both being fully exposed. One of these, built with the overhead system, suffered all the troubles encountered in the average cold storage house, viz.: Poor circulation, a wet ceiling in ice chamber, caused by warm air coming in contact with a cold ceiling, the condensation falling on the ice and causing it to honeycomb and waste rapidly; and I was told this house used $3,500 worth of ice the first year. The other, built on a different principle of circulation and construction, seemed to be as free from these faults as the other was afflicted with them, and used only $2,300 in one year, having the advantage over the first of $1,200 a year in the cost of cooling, to attain and hold a temperature of 34° to 35° with ice. [It is now cooled by machine, and held at 34°, the management not wanting a lower temperature.] This simply shows how widely men will differ in their ideas—on paper—and how widely those ideas differ when put in practice.

AN ARKANSAS COLD STORAGE HOUSE.

On reaching Hot Springs, Ark., I found that Armour Packing Co., shippers of dressed meats, etc., had recently purchased a site there at an expense of $13,000 (or about $264 per front foot), upon which they will erect a cold storage house, using the Black improved cold storage system, to be used by them for the storage of fresh beef, pork, mutton, etc. They claim that by this system (Black's) the stock is kept dry and sweet to their entire satisfaction, and say that they have adopted this system for the construction of all their future storage stations. The new plant at Hot Springs is a model, and so handsome and complete that I have secured copies of the elevations and ground plans, which I herewith send you to illustrate this article if you so desire.



FRONT ELEVATION ARMOUR PACKING CO.'S NEW PLANT, HOT SPRINGS, ARK.



FIRST FLOOR PLAN ARMOUR PACKING CO.'S NEW PLANT, HOT SPRINGS, ARK.

The probable cost of the building is not known at this writing, but the work has been begun under the local superintendence of Mr. Harry Jones, in accordance with drawings approved by the patentee. The building is on the main street, directly opposite the passenger depot, making a very imposing appearance. It has a front of sixty feet by a depth of 105 feet, and will have an 8-foot cellar with granitoid floor. The foundation walls will be of stone laid in cement, that portion above ground to be broken ashler laid in black mortar, with bead joints. All other walls will be of hard red brick, laid in cement mortar, and faced with Malvern pressed brick, with Pecora red mortar, and enriched with carved

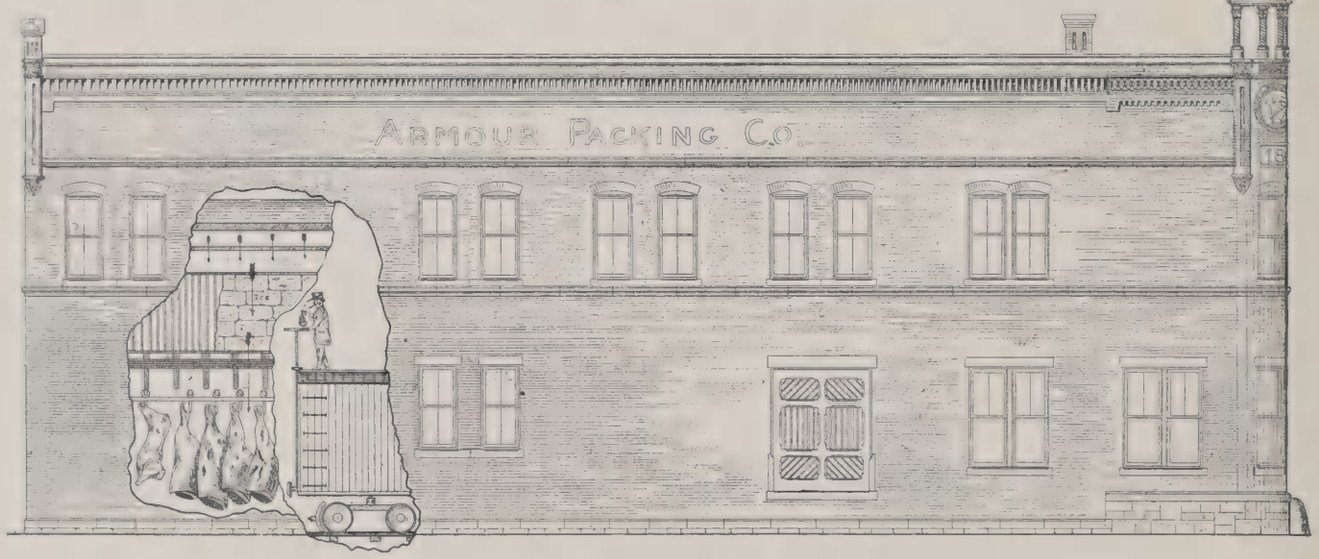
stone work. The cornice and tower will be as shown in the drawings.

Plate glass will be used in the large windows, and ordinary French sheet glass in all other sash. The office and sales room will have an egg-shell finish on white ash, while the cold storage and freezing rooms, vestibule, etc., will have pure white ceilings, as smooth as ivory. The walls will be white ash, with natural wood finish.

The storage rooms will be perfectly dry, free from odor of any kind, well lighted with windows and electric light; will have overhead railways connecting with the cars and salesroom, and a track scale for weighing, making the plant a model of perfection.

The ice will lie overhead, out of sight. Being stored from above, no drip or dampness enters the storage room.—indeed, so dry that a match may be lighted on the ceiling over the ice in the ice chamber, and no honeycombed ice, an even meltage, and only enough ice exposed to produce the temperature required. This company, they tell me, has a cooler at Savannah, Ga., using this system with a temperature of 34°, cooled by machine; and one at Atlanta, Ga., that stands at 35°, cooled with ice, and expects this Hot Springs house to be not warmer than 34° or 35° without salt; though of course in their freezing room salt will be used. The cost of construction is no more than other systems; in fact, not so much as some; and the plan is well adapted to either ice or machine as a cooling agent, and is used both ways satisfactorily. The unpleasant drip from pipes or pans is avoided by placing them above in a properly constructed loft, and securing a circulation of air, which they fail to have where pipes or pans are strung around the walls of storage rooms, in the old way.

I am indebted to Mr. S. S. Jerome, the genial southern manager for Armour & Co., for courtesies extended while in Hot Springs. Mr. Jerome claims that their cold storage houses will last indefinitely, and takes pleasure in recommending the system.



SIDE ELEVATION ARMOUR PACKING CO.'S NEW PLANT, HOT SPRINGS, ARK.

NEW COLD STORAGE PLANTS.

ALABAMA.

Mobile—The Mobile Brewing Co. have contracted for a 50-ton refrigerating machine with the Columbus Iron Works Co.

ARKANSAS.

Hot Springs—Armour & Co., packers, will erect a cold storage house for preserving dressed meat, to be constructed in accordance with the A. W. Black system.

ILLINOIS.

Dixon—The Dixon Ice Co. will build this winter a cold storage house to be cooled with natural ice.

INDIANA.

Indianapolis—The Home Brewing Co. are erecting a Weisel & Vilter machine, 75-ton direct expansion.

MARYLAND.

Baltimore—The Baltimore & Cold Storage and Warehouse Co. have taken out a permit to erect a four-story warehouse at 410 South Eutaw street.

MISSOURI.

St. Joseph—W. L. Distin, produce dealer, is talking of building a cold storage house.

OHIO.

Cleveland—The Barrett Brewing Co. have in course of erection a 50-ton direct expansion Weisel & Vilter machine.

PENNSYLVANIA.

Allegheny—The F. L. Ober & Co. Brewing Co. has just completed the erection of a 50-ton direct expansion Weisel & Vilter machine.

Philadelphia—Weisbrod & Hess, brewers, are erecting a 50-ton, brine system, Weisel & Vilter machine, and have another similar machine under contract.

Pittsburgh—The Phoenix Brewing Co. have put in a 50-ton direct expansion Weisel & Vilter machine.

TEXAS.

Dallas—A cold storage house will be erected by the Butchers' National Protective Association. The capital stock of the company will be $50,000, of which a large part has already been raised.

VERMONT.

Plainfield—C. C. Beaman is having a cold storage building erected at the "Butternuts," and will build an addition to his ice house at Blow-me-down, and convert it into a cold storage. C. F. Lewin claims to be the inventor of the building.

WASHINGTON.

Seattle—Henrich & Co., brewers, have contracted for their second 25-ton, brine system, Weisel & Vilter machine.

WISCONSIN.

La Crosse—C. & J. Michel Brewing Co. will put in a 50-ton direct expansion Weisel & Vilter machine.

Watertown—The cold storage building for cheese, now being erected by Habbegger & Jossi, will be 30×75 feet, and thirty feet high. The upper floor will have capacity for 600 tons of ice.

——An ice ordinance has been passed at Topeka, Kan., amending the previous ordinance of the same sort so as to read "No person, either as a principal or an agent or an employe, shall sell or offer for sale, any impure ice in the city of Topeka. Any person violating this section shall upon conviction be fined not less than $10 nor more than $100 for each offense, provided that this section shall not apply to ice used for refrigerating purposes."

[*Written for* ICE AND REFRIGERATION.]

COST OF REFRIGERATION.

THE QUERY STATED—ITS INDEFINITE CHARACTER—REPLIES BY VARIOUS CORRESPONDENTS WITH THEORETICAL ESTIMATES, CONDITIONS OF DETAIL ASSUMED.

BY JOHN E. STARR, D. B. BEEMER AND OTHERS.



SOME time ago ICE AND REFRIGERATION received the following query: "Will you kindly give in your next issue the expense of refrigerating a room for each 1,000 cubic feet, at a temperature of 37°, the outside temperature being 74°?" The query, as will readily be seen, is very indefinite; yet as the question promised to develop some interesting and valuable facts, the editor submitted it to several readers of ICE AND REFRIGERATION for the benefit of the trade in general. This method of answering inquiries is, we believe, new with us; but we believe it preferable to making direct answer ourselves, as is done in the case of minor questions in the department of "Answers to Correspondents." And we are confirmed in this belief by the kindly note of Mr. John E. Starr, who has heretofore so ably discussed the great problem of "Insulation" in these columns, who says: "I am glad to see inquiries of this kind coming in. If the consuming public generally got to figuring a little on this subject, there would be a lot of money saved to them without lessening the sale of refrigeration. Better service is worth more than smaller ice bills." With this explanation we now proceed to the views of various correspondents:

THE ABSENCE OF DETAIL NOTED.

Mr. W. B. Baker, of the Pure Ice and Cold Storage Co., of Springfield, Ill., says: "There are so many different conditions to be considered that it is very hard to answer intelligently as to the contents of room, if any, the insulation and surroundings, how much it is opened, and whether vestibuled or not; the distance from the brine tank or compressor—a hundred different conditions may exist. For instance, we have one room containing about 2,000 cubic feet for fruit, which we can hold at 36° (kept closed) for sixty days at less than one-fourth the cost of cooling another room containing 4,000 cubic feet for thirty days, in a slightly different locality, which is opened for commercial purposes several times daily. We cool by pumping brine from the freezing tank through pipes on the walls of the rooms. The cost of keeping the small room cooled to 37°, after its contents are thoroughly cool, is so slight we don't know how to compute it. Certainly it is less than one ton of ice per month. We shall be glad to hear from other parties on this subject."

Mr. Stuart St. Clair, general manager of the York Manufacturing Co. (Ltd.), of York, Pa., says: "The query is a difficult one to answer, in the absence of any knowledge of the nature of its contents; and any approximate or off-hand statement might be misleading. All classes of storage, whether solids or liquids, have their specific heat, consequently are refrigerated at variable cost. Another very important factor would be the insulation, as at the difference in temperatures mentioned the radiation would be considerable. It is presumed that the query is made for practical purposes, and the writer cannot see how it can be disposed of in its present form with any accuracy, and will await with interest the replies from other sources."

AN ESTIMATE—CERTAIN DETAILS BEING ASSUMED.

Mr. John E. Starr, of the St. Louis Automatic Refrigerating Co., St. Louis, Mo. (to whose previous articles on "Insulation" the reader and our inquirer are referred), writes as follows: "Like many questions of this kind, the inquiry does not state conditions that are absolutely necessary to be given in order that figuring toward a correct answer may be properly based. As I roughly pointed out in a couple of articles on 'Insulation,' printed in your July and September numbers, the amount of refrigerating material used depends rather on the square surface of the room than on the cubical contents; also on the work to be done toward cooling the goods placed in the rooms, and the character of the insulation. Your inquirer does not state any of these conditions, nor does he assume a market price for his ice or other refrigerating material. These various conditions must be assumed, otherwise a practical answer cannot be given.

"To illustrate: A room five feet wide by forty feet long by five feet high would contain 1,000 cubic feet, and would expose 850 square feet to the outside temperature; while a room 10×10×10, also containing 1,000 cubic feet, would expose 600 square feet. It is plain that the first room would require about forty per cent more ice than the second room to maintain the differences of temperature given, supposing equal insulation, and leaving cooling of material out of the question. The character of the insulation, of course, is an all-important condition, as the variation in this respect between different refrigerators is found in practice to be enormous—as high as 500 and 600 per cent.

"In order that your correspondent may get at something from which he can fairly estimate the cost, let it be assumed that his room is 10×10×10, containing his 1,000 cubic feet, and exposing 600 square feet; that the goods are placed in the room at the same temperature as the required room temperature (37° F.), and that the doors are not opened very often, say ten or twenty times in twenty-four hours. The value of the insulation is difficult to assume, but say it is the average of separate refrigerators of about this size usually found in commercial practice—neither very good nor very bad. The poorest refrigerators coming under my observation conduct about five B. T. U. per degree of difference in temperatures per square foot of surface per day, and the best about one B. T. U. I would say that, taking them as they come, the average of what are considered fairly good refrigerators show a rate of about three B. T. U. per square foot per degree per day per degree of difference, and will, therefore, assume this grade of insulation. Also assume that the circulation is fair, and that the air in the ice bunker, therefore, is nearly the same temperature as the air in the body of the box.

"The outside temperature, stated in the inquiry, is 74° and the inside 37°, and the difference 37°. The rate of conduction, therefore, would be per day 600 (square feet) ×37 (degrees difference) ×3 (B. T. U. per square foot)=66,600 B. T. U. The amount of ice used would

be $\frac{6000}{142}$=469 pounds per day. About 10 per cent may be fairly added for opening doors, lower temperature in ice bunker, ventilation, etc., making 469 pounds +47 pounds= 516 pounds of ice per day. If ice costs the owner of the room say $5 per ton, his bills for maintaining the temperature given, supposing no work was to be done in cooling down goods, would be $1.29 per day.

"Now, if goods were placed in the box at a higher temperature than 37°, the extra cost would be in proportion to the amount and temperature of the goods. For example, if 3,000 pounds of meat to be cooled to 37° were placed in the box each day, and if the temperature of the meat was about that given for the outside air (74°), it would take roughly

$$\frac{3000\times(74-37)\times.7}{142}=547 \text{ pounds}$$

of ice additional per day, taking .7 as the specific heat of meat. Hence, the total amount of ice used per day, in a box of the kind mentioned, with outside temperature of 74°, and inside temperature of 37°, cooling 3,000 pounds of meat from 74° to 37°, would be 516 pounds+ 547 pounds, or 1,063 pounds per day, and the cost, at $5 per ton for ice, would be $2.66 per day. It must be remembered, however, that this is assuming a certain value of insulation. A room which your correspondent might build might use considerably more or considerably less ice than this, according as his insulation was better or poorer than the insulation assumed.

"Again, it must be remembered that this is not the rate *per thousand cubic feet*. A box 2,000 cubic feet, built in the same form (a cube), with insulation and other things equal, would not use twice as much ice, as the amount of refrigeration required, as far as insulation is concerned, is in proportion to the amount of surfaces, and not cubic contents.

"To your editor's addendum to the question, as to whether the estimated cost is based on refrigeration by ice or by mechanical means, it may be said, that having expressed the refrigerative duty in terms of melted ice, the cost of mechanical refrigeration can be easily figured, as the work of refrigerating machines is always rated in the same terms. Obviously, however, it would not pay to put in a machine to do only this small amount of duty. If the work was performed by mechanical means, supplied by a pipe line from a central station, the cost to the consumer would be regulated by the competitive market, based on ice values. Pipe line refrigeration, at present, keeps somewhat under the ice market. One advantage the customer has by this method lies in the fact that considerably more cubic space, that would be occupied by ice, and, therefore, useless, is made available for storage in the mechanical system."

A LOW TEMPERATURE EASIER TO HOLD THAN A COMPARATIVELY HIGH ONE.

Mr. D. B. Beemer, of Omaha, Neb., one of the pioneers in the cold storage business, a gentleman of long experience, says:

"The question is a very indefinite one in its bearings, from the fact that the location of the room in question is not given, nor the degree of cold required in it."

"In the first instance, location would figure largely, perhaps, in the cost of the ice used to cool the room. In the next place, temperature required would figure largely in the amount of ice necessary to do the work, for, strange as it may seem to a person not posted in the principles governing cold storage, it requires less ice to keep a room and its contents at near freezing point, or say from 28° to 36° F., after being once chilled down to such temperature, than it does to hold it at 40° to 50° F. and above; in fact, it requires the use of almost as much ice to hold it at this last temperature as to hold at 20° to 25°.

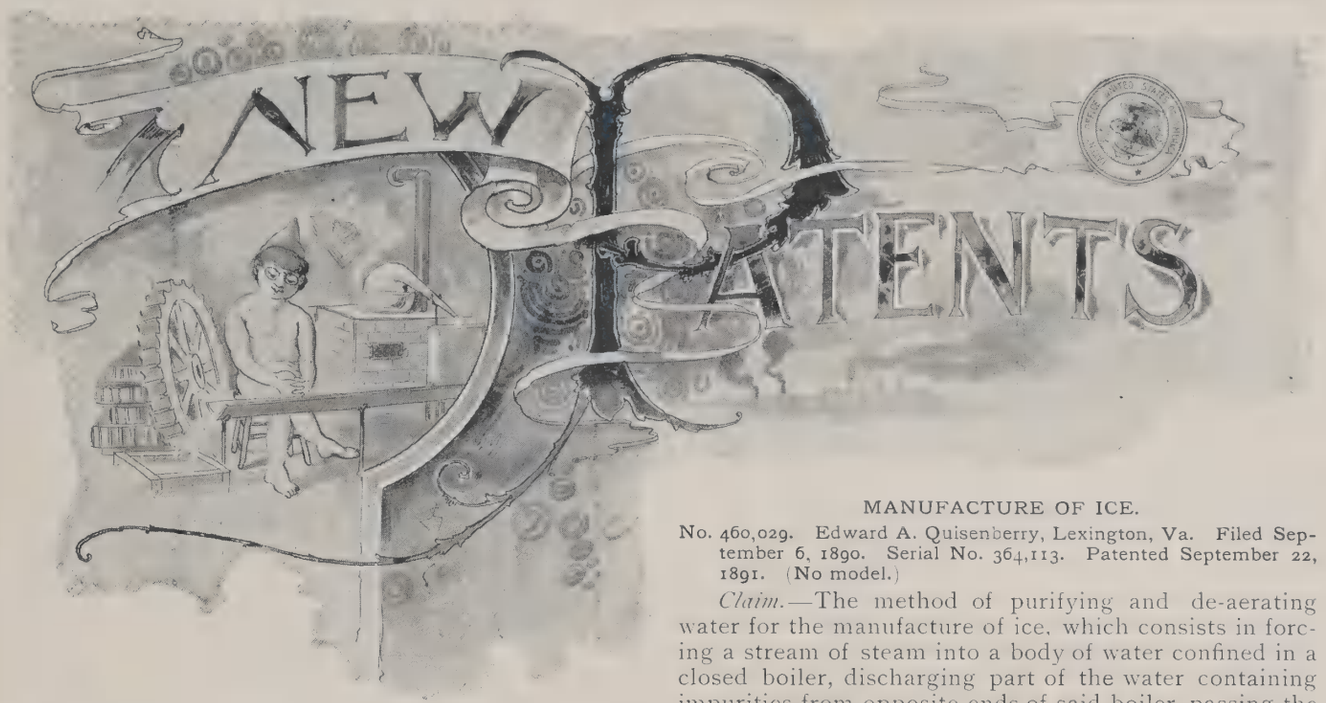
"At about the freezing temperature, the contents of a room, when once chilled down, nearly refrigerate themselves, instead of wearing on the ice, as the higher temperature in the other room will do. Being in ignorance of the cost of ice in his locality, and of the temperature required, I can only figure upon the approximate quantity of ice required in such a room, properly insulated, to maintain certain temperatures in it.

"A room containing 1,000 cubic feet, as described, would be equivalent to one of the following dimensions —10×10×10. A room of this size, properly tanked on my system, could be held full of eggs at a temperature of 34° to 37° F. by the daily use of 200 to 300 pounds of ice, and two or three quarts of coarse salt after contents of the room had been chilled down to this temperature. Under similar conditions, a temperature of 20° to 25° could be maintained by using 500 pounds of ice and six quarts of salt daily; and it would take about this quantity of ice and twenty-two quarts of salt to maintain a temperature of 40° to 45° F."

AN APPROXIMATE ESTIMATE.

A gentleman using the anon "Iago," but whom we know to be a man of wide and extensive experience in cold storage, writes: "I would say that the kind of insulation and the outside area of the room must be taken into account. The percentage of expense for chilling a large room would be much less for the space cooled than for a small room of 1,000 cubic feet, the refrigeration, or meltage of ice, being as to the amount of wall, roof and floor surface of a storage house exposed to outside influence; and as this room is too small to expect the use of a machine, except in large cities where pipes are laid through the streets, I will confine myself to Black's improved cold storage system, and take a room 10×12½ feet, eight-foot story, with five feet of ice overhead, thereby exposing 850 square feet of surface to outside influence. Estimating each 100 square feet to represent a meltage of from twenty to twenty-five pounds of ice, we have an approximate cost of from 170 pounds to 215 pounds per day of ice at twenty-five cents per 100, or forty-two to fifty-three cents per day."

"To make an ice machine pay in a brewery," says the Australian *Brewers' Journal*, "many minor details have to be considered. First comes, naturally, the economical working, and then the distribution of the cooling power, which may be effected by blowing cool air from a refrigerating chamber into the cellar, or by suspending from the ceiling a number of iron pipes, in which cool brine circulates. All openings must be fitted with double windows and doors, and the daylight excluded as far as possible. When these primary rules are observed, no trouble should arise in keeping a constant and even temperature in the cellar in the hottest weather, and the yeast will be better preserved from attack by wild yeast and bacteria, the beer will keep cool, preserve its flavor, accumulate more carbonic acid gas, and last, but not least, it will acquire that peculiar fullness and palate of which it is now almost destitute."

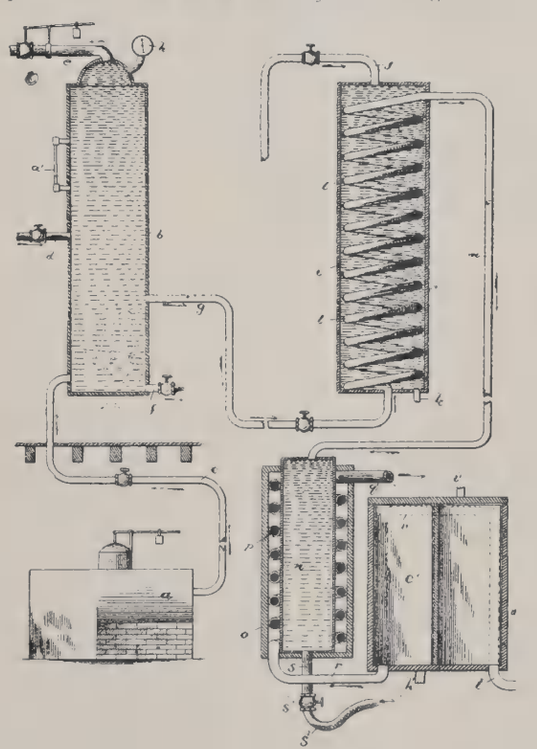


We append below the most important new patents, relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

METHOD AND APPARATUS FOR MANUFACTURING ICE.

No. 460,028. Edward A. Quisenberry, Lexington, Va. Filed May 20, 1890. Serial No. 352,470. Patented September 22, 1891. (No model.)

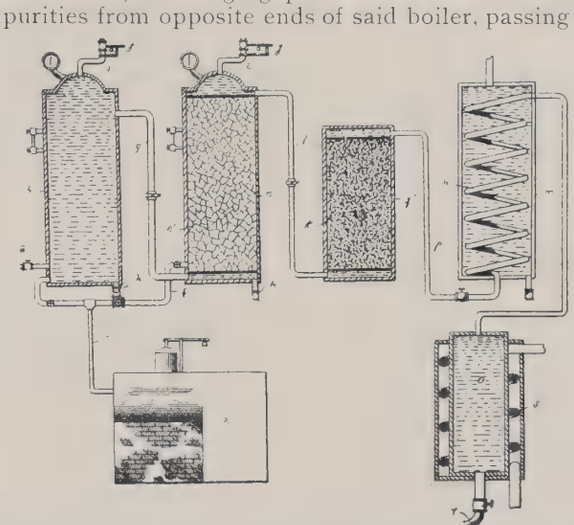
Claim.—In the manufacture of ice, the herein-described mode of de-aerating water, which consists in completely filling a closed tank with the water to be frozen, forcing a stream of live steam directly into said confined body of water, blowing off a portion of said water from the upper end of the tank, thereby removing air and impurities contained therein, removing the purified, de-aerated water from said tank at a point above its bottom, cooling the same out of contact with the outer air, discharging the same into the freezing cans, and freezing the same without admitting air thereto, as set forth.



MANUFACTURE OF ICE.

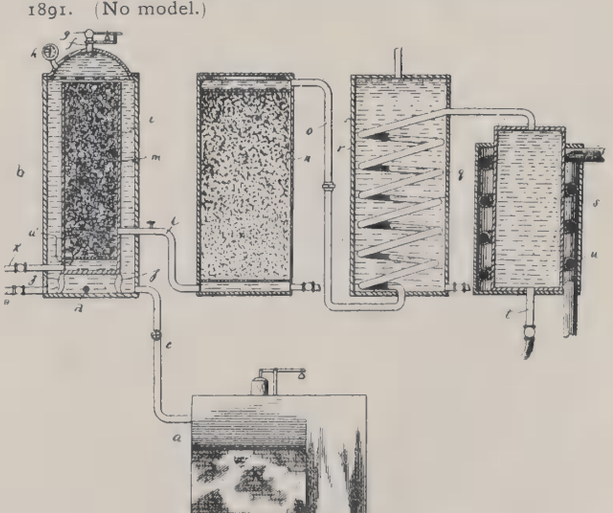
No. 460,029. Edward A. Quisenberry, Lexington, Va. Filed September 6, 1890. Serial No. 364,113. Patented September 22, 1891. (No model.)

Claim.—The method of purifying and de-aerating water for the manufacture of ice, which consists in forcing a stream of steam into a body of water confined in a closed boiler, discharging part of the water containing impurities from opposite ends of said boiler, passing the water from said boiler and discharging a stream of live steam into said water while confined and in the presence of filtering material, and then cooling the water and discharging the same into a supply vessel in a purified and de-aerated condition for freezing, substantially as described.



APPARATUS FOR DE-AERATING WATER.

No. 460,030. Edward A. Quisenberry, Lexington, Va. Filed November 29, 1890. Serial No. 373,046. Patented September 22, 1891. (No model.)



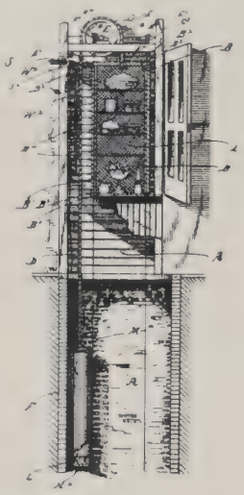
Claim.—In combination, the closed boiler having a discharge or blow-off from one end, and steam and

water supply pipes, and the small inner vessel within said boiler arranged so that the water flows from the upper portion of the boiler into said inner vessel and the de-aerated water discharged from the inner vessel.

REFRIGERATOR.

No. 461,378. Horace R. Allen and Joseph A. Minturn, Indianapolis, Ind. Filed June 9, 1890. Serial No. 354,810. Patented October 13, 1891. (No model.)

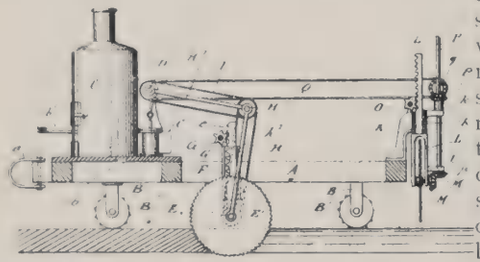
Claim.—In a well refrigerator, the cage, a drum above the same, and a cable secured at one end to said cage, passing over said drum and extending downward within the well beside said cage, in combination with an elongated water tank secured to the lower end of said cable, and formed with an opening, a valve closing said opening, means substantially such as described, for operating said valve from the top of the well, an elongated water pipe extending downward from the top of said well beside said cage, and adapted to be entirely enveloped by said water tank when the latter is in its uppermost position, and a spring-closing cock adapted to check the flow of water through said pipe.



ICE CUTTING MACHINE.

No. 460,440. Thomas F. Lynch, Philadelphia, Pa. Filed December 22, 1890. Serial No. 375,449. Patented September 19, 1891. (No model.)

Claim.—An ice cutting machine comprising the frame, a motor thereon, a main drive shaft operated thereby, two vertically sliding racks mounted in ways on the frame, shafts provided with gears meshing into said racks to raise and lower them, locking devices for said shafts, strip cutting and block cutting circular saws journaled in the lower ends of said racks at right angles to each other, belting connecting the main drive shaft and the shaft of the strip forming saw, a vertically sliding shaft *P*, geared at its lower end to the shaft of the block forming saw, a bevel gear through which said vertical shaft freely passes, and connected therewith by a spline and groove, and a counter-shaft geared to said bevel gear and belted to the drive-shaft, substantially as set forth.



WANTED AND FOR SALE ADVERTISEMENTS.

(The charge for advertisements in this column is $3 each insertion for seventy words or less, and twenty-five cents for each additional fourteen words. No advertisements will be inserted unless accompanied by the necessary cash. Parties answering these advertisements must write to the addresses given, as the Publishers decline to furnish any information concerning them.)

Ice Machine Wanted.

Wanted, an Arctic ice machine, 10 tons capacity, with graduated cut-off. Must be nearly new. Address, with full particulars, "ARCTIC," care of ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Ice Machine Wanted.

The subscriber would like to receive terms and particulars of a 10-ton compression ice machine, second-hand, which is for sale. Address, "COMPRESSION," care of ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Second Hand Ice Machine for Sale.

A second-hand ice machine, in good running order, will be sold cheap for cash. Has a capacity of 45 tons of ice per day. Address "J. B. C.," care of ICE AND REFRIGERATION, 177 La Salle street, Chicago.

Ice Machine for Sale.

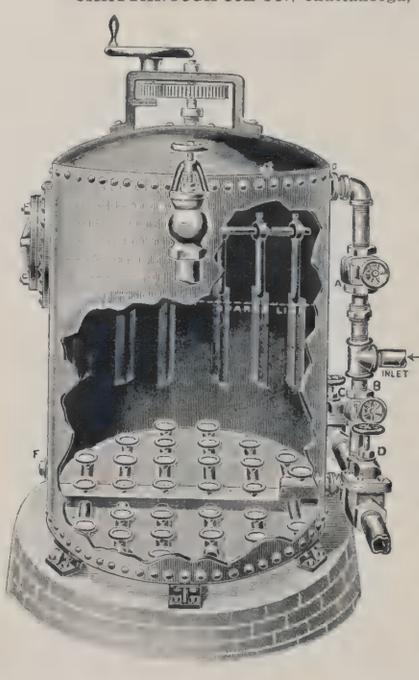
A complete ice machine, having a capacity of 5 tons daily, for sale at a bargain. Machine is in running order, and will be guaranteed. It has been taken out to make room for larger machine, which is the reason for selling. Address, "X.Y.Z.," care ICE AND REFRIGERATION, 177 La Salle street, Chicago.

O. H. Jewell Filter Co.

73 & 75 WEST JACKSON ST.,

CHICAGO.

REFER BY PERMISSION TO
DIAMOND ICE CO., Wilmington, Del.
CHATTANOOGA ICE CO., Chattanooga, Tenn.



The Filter Medium does not require to be changed; it being cleaned by simply reversing the flow of water. This Filter may be used to purify water for boiler evaporation or for removal of oil from condensed water before passing to the freezing cans, as also for any other duty requiring pure and wholesome quality of water.

Made in Capacities Upwards of 500 Gallons.

We also manufacture Gravity Filters of any Capacity.

GROUND CORK

FOR INSULATING PURPOSES.

Cold Storage Rooms, Refrigerator Cars, Brewers, and all [illegible] purposes. Large stock on hand which will be delivered at low prices.

MACKOLITE . . HOLLOW BLOCKS

UNEQUALED as a non-conductor of heat in all dry storage rooms and situations. They are **FIRE-PROOF**, and when exposed to a red hot fire on one side will bear the hand on the other.

MACKOLITE PLASTER BOARD COMPANY,

807 CHAMBER OF COMMERCE, CHICAGO . . .

Engineers Who Write

to us will always receive valuable information in regard to reducing Valves, Pump Pressure Regulators and Pump Governors, which we manufacture. These are standard goods, of the best material and workmanship, on the market. We also manufacture an iron reducing valve, suitable for use on an ammonia apparatus.

MASON REGULATOR CO.
BOSTON, MASS.

F. L. GALIGHER,

ICE AND REFRIGERATING MACHINE SUPPLIES

Machines Purchased, Erected and Results Guaranteed.

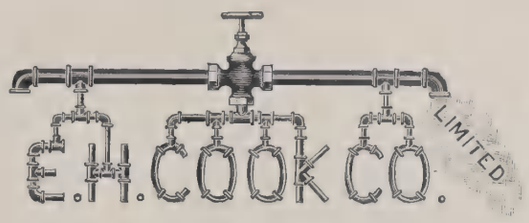
CAPACITY OF PLANTS INCREASED
AT A MINIMUM COST.

Repairs and Alterations Made.

. . Perfected Distilled Water Apparatus for Ice Factories, Pure Water Co.'s, Chemists, and Caraffe Freezing.

EXPERTS FURNISHED. CORRESPONDENCE SOLICITED.

ROOM 709
CHAMBER OF COMMERCE BUILDING,
CHICAGO, ILL.



ENGINEERS AND CONTRACTORS FOR

Ventilating

WATER AND . . . STEAM HEATING.

ALSO EXPERTS IN

Brewery and Refrigerating ... WORK ...

GREENHOUSE HEATING
AND STEAM LAUNDRY WORK.

PUMPS

Damper Regulators, Feed Water Heaters, and all kinds of Engineers' Supplies.

Nos. 92 and 94 Andrews Street,

ROCHESTER, N. Y.

STEAM ICE CUTTER

THE KEY TO THE COMBINATION FOR PRODUCING THE FINEST QUALITY OF ICE AT LOWEST COST.

No Brine, No Cans or Plates, and No Distilling Apparatus Used.

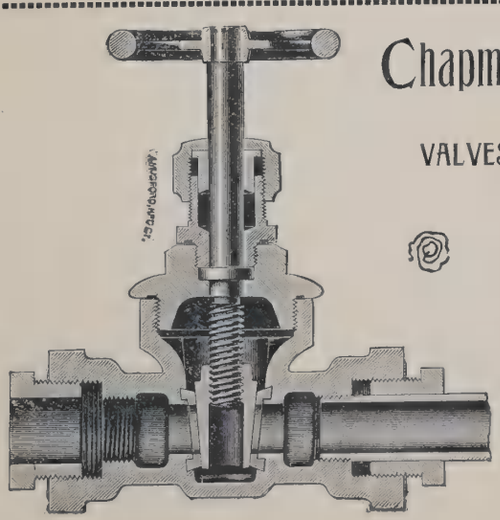
One form of Cutter is used by the Diamond Ice Co., Wilmington, Del., and the Consumers' Ice Co., New Orleans, for cutting up their plate ice. Other forms of cutters are designed to harvest the ice from the freezing tanks, either plate ice or block ice, according to the construction: the block ice being the size of can ice, but almost identical with plate ice in transparency, cleavage, taste, and for storage, is without cone. The reduction in cost of ice plants, resulting from these improvements, would be about $150 per ton capacity on plate plants, and about $100 per ton capacity on can plants. Plate Ice can be made in 8 days, and block ice in 2½ days. Can Plants may be changed to the block system at moderate cost.

(Patents Pending.) **LEA PUSEY, Wilmington, Del.**

CRANE COMPANY, CHICAGO.

SPECIAL WROUGHT IRON PIPE

. . . . . For Ice Making and Cold Storage.



Chapman Valve Manufacturing Co.

.....MANUFACTURERS OF.....

VALVES AND GATES FOR WATER, GAS, STEAM, ACID, OIL, AMMONIA, ETC.

ALSO GATE FIRE HYDRANTS

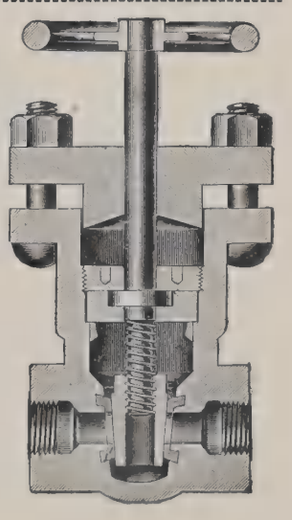
SPECIAL ATTENTION GIVEN TO

VALVES FOR REFRIGERATING, COLD STORAGE, ICE MAKING MACHINERY, ETC.

We make the best Valve for Ammonia Heavy Pressure in the market. The two illustrations here represent Ammonia Valves that are giving universal satisfaction.

General Office and Works,
INDIAN ORCHARD, MASS

Treasurer's Office,
72 Kilby and 112 Milk Sts. BOSTON, MASS.



DIRECTORY OF

Ice Factories, Ice Dealers and Cold Storage Houses.

THE PICTET ICE WORKS,
Manufacturers of Artificial Ice from Filtered and Double Distilled Lake Erie Water.
Capacity, 30 tons per day.
20, 22 & 24 Center St., Cleveland, O.

THE WASHINGTON MARKET CO.
Central, accessible and close to business, with over 300,000 feet cold storage space.
Center Market: 7th and Pa. Ave., N. W.,
Washington, D. C.

CENTRAL ICE CO.
REPRESENTING Lookout Ice & Cold Storage Co.
Chattanooga Ice & Bottling Co.
Ice Capacity, Big Spring Ice Co.
125 Tons daily. Chattanooga, Tenn.

NORTHWEST COLD STORAGE & ICE CO.
WM. McGUIRE, Sec'y and Treas.
C. H. PRESCOTT, Pres. J. C. LEWIS, Vice-Pres.
WM. McGUIRE, Mgr. Portland, Ore.

STANDARD ICE CO.
Daily capacity, 135 tons.
Office: Wall Street.
Factories: Atlanta, Iceville and West End.
MORRIS BENJAMIN, Mgr. Atlanta, Ga.

J. WALTON CURTIS,
ICE BROKER,
Ice bought and sold on commission.
P. O. Box 1264. Boston, Mass.

EXCELSIOR ICE & COLD STORAGE CO.
Ice capacity, 80 tons daily.
W. H. HOWE, Prop. Nashville, Tenn.

GEORGIA ICE CO.---N. O. ICE MFG. CO.
Capac'y, 40 tons daily. Capac'y, 80 tons daily.
J. M. BEATH, Gen. Mgr. H. H. BLANK, Supt. N. O.
Atlanta, Ga. New Orleans, La.

JAMES McCARTHY & SON,
Wholesale and Retail dealers in Ice,
Winter and Summer Shipments,
Lake Bras D'Or, Nova Scotia.

GIFFORD BROS.

HUDSON, NEW YORK.

ICE

ELEVATING
CONVEYING
LOWERING

Send for Catalogue and Price List,

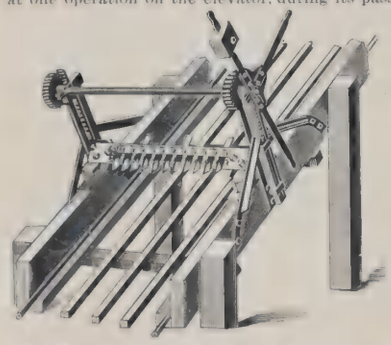
MACHINERY

ALSO

CHAIN, FORGINGS, ENGINES AND BOILERS.

Briggs' Corrugating Elevator Plane

For reducing ice to an even thickness and corrugating it upon the upper surface at one operation on the elevator, during its passage from the water to the house.



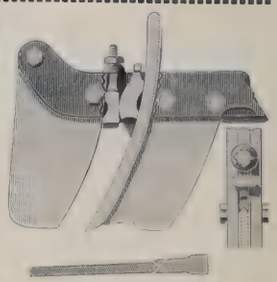
It will cut off any amount necessary, leaves the top of the cakes dry and slightly corrugated. It gives level floors, and the ice can be stored with less labor and will come out very much easier and with less breakage than if not planed and corrugated.

CAUTION.

Planes using cutters which have cutting edges that diverge from the entering point of the cutters, whether made singly or in sections, infringe my rights under letters patent, the users of which I shall hold liable to me in damages.

JOHN N. BRIGGS, Coeymans, Albany Co., N. Y.

ICE TOOLS



HENRY BODENSTEIN,
(Successor to J. G. & H. Bodenstein.)
MANUFACTURER,
Staatsburg, Dutchess Co., N. Y.

MANUFACTURER OF THE

PATENT **Inserted Tooth Ice Plow**

PAT. EXTENSION GAUGE

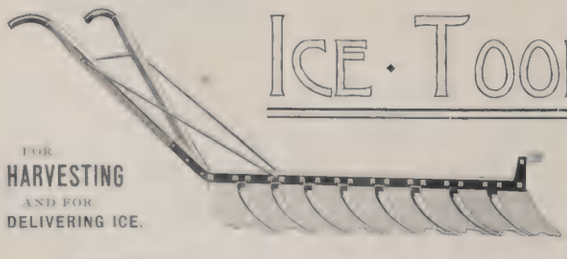
AND ALL OTHER ICE TOOLS.



Repairing Promptly and Neatly Executed.

All Work Warranted to Give Satisfaction.

ICE TOOLS



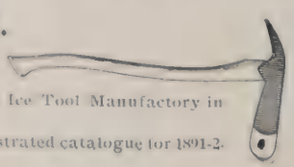
FOR **HARVESTING** AND FOR **DELIVERING ICE.**

Of Every Description.

MANUFACTURED BY **WM. T. WOOD & CO.**

ARLINGTON, MASS.





The oldest and largest Ice Tool Manufactory in the United States.
Send for complete illustrated catalogue for 1891-2.

PETER GERLACH & CO.

CLEVELAND, OHIO.

MANUFACTURERS OF THE FINEST

ICE TOOLS

FOR

HARVESTING . .
STORING . . . .
AND DELIVERING ICE.



SEND FOR PRICE LIST.



NEW FEED-WATER PURIFIER AND HEATER

USES LIVE STEAM

This cut shows our Feed Water Heater and Filter combined. Perfectly purifies the feed-water and delivers it to the boiler freed from scale producing elements and sediment. FULLY GUARANTEED.

STILWELL'S PATENT IMPROVED

Lime Extracting Heater. Uses Exhaust Steam. Separates the oil from the Steam and Water. It Regulates the Feed. The Pipes Never Pound. Prevents Scale in Steam Boilers, removing all Impurities from the water before it enters the Boiler.

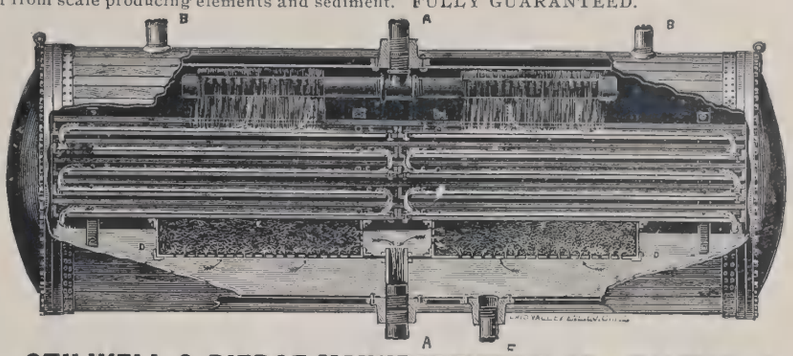
THOROUGHLY TESTED.

Over 4,500 of them in daily use.

This upright view is a fac-simile of the appearance of the shelves of a No. 5 Heater at work on ordinary Lime Water, when the door was removed after the Heater had been running two weeks.

ILLUSTRATED CATALOGUE FREE.

ESTABLISHED IN 1866.....



STILWELL & BIERCE MANUFACTURING CO., DAYTON, O.

SELDEN'S PATENT PACKINGS

FOR STUFFING BOXES



The BEST Packing for Ammonia, Air, Steam or Water. Used in Ice and Refrigerating Plants in this and other countries. Give it a trial. If your supply store does not keep it in stock, ask him to get it from the manufacturer.

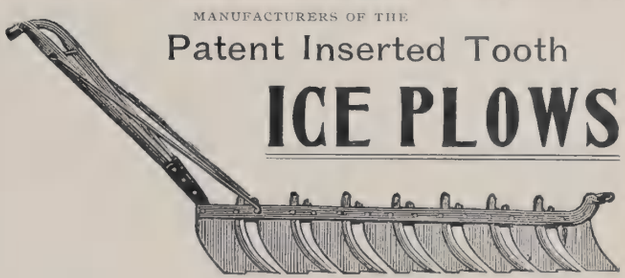
RANDOLPH BRANDT,
38 Cortlandt St.,
New York, U. S. A.

J. G. BODENSTEIN & CO.

MANUFACTURERS OF THE

Patent Inserted Tooth

ICE PLOWS



OLD STYLE PLOWS, AND ALL OTHER ICE TOOLS

Before purchasing elsewhere send for our descriptive catalogue and price list.

STAATSBURG, N. Y.

FOREST CITY PACKING CO.

MANUFACTURERS OF

HIGH GRADE AMMONIA AND ENGINE PACKING . . .

69 FRANKFORT,

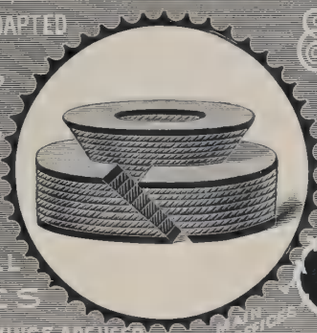
CLEVELAND, OHIO.

THE GARLOCK PACKING CO.

ELASTIC RING, SECTIONAL AND SPIRAL PACKINGS

ESPECIALLY ADAPTED FOR STEAM, WATER, AMMONIA AND ALL PLACES WHERE PACKINGS ARE USED.

EQUALED BY NONE







PALMYRA, N.Y. ROME, GA. OMAHA, NEB. | PITTSBURGH 54, 5th AVE | NEW YORK 194 WATER ST. | CHICAGO 94 FRANKLIN ST. | PHILADELPHIA 226 & 24[illegible] ST. | PORTLAND, ORE.

STROMBERG, ALLEN & CO.

RAILROAD AND COMMERCIAL

Printers

ENGRAVERS
LITHOGRAPHERS
ELECTROTYPERS

PRINTERS OF
ICE AND REFRIGERATION

MANUFACTURERS OF

LIGHT RAILROAD SUPPLIES

Consecutively Numbered Tickets, Bonds, Checks, etc., a specialty

337 AND 339 DEARBORN ST., CHICAGO

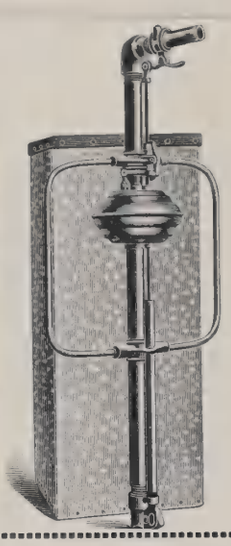
THE CANTON STEEL ROOFING CO.

MANUFACTURERS OF . . . .

ICE FREEZING CANS

Insulating and Sheathing Papers, . .
Steel Roofing, Corrugated Iron, . . .
Eaves Trough, Conductor, Etc. . . .

Canton, Ohio.



E. C. SAULS. C. G. SAULS.

SAULS BROS.

MANUFACTURERS OF

Sauls' Automatic Ice Can Filler

Fills Automatically and prevents flooding the bath. Save time, labor and money. Over

: : 150 : :

In use in prominent factories. Send for testimonials and prices.

SAULS BROS.
COLUMBUS, GA.

WINGATE & MELL,

MANUFACTURERS OF : : : ICE.CANS

WRITE FOR ESTIMATES.

44 & 46 North Broad Street, ATLANTA, GA.

TANKS AND SHEET IRON WORK

OF EVERY DESCRIPTION.



CONTRACT FOR THE COMPLETE EQUIPMENT OF

ICE MAKING AND COLD STORAGE PLANTS.

A. W. SWANITZ, CONSULTING ENGINEER,

AND EXPERT IN

Ice AND Refrigerating Machinery

CORRESPONDENCE SOLICITED . . .

701 STOCK EXCHANGE BUILDING,

CHICAGO.

SEIBEL-SUESSDORF

COPPER AND IRON MFG. CO.

MANUFACTURERS OF

Sheet Iron Tank Work

FOR ICE FACTORIES, PACKERS, ETC.

Also Manufacturers of Galvanized Iron . .

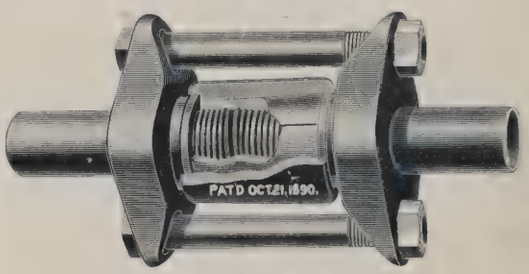
ICE CANS

SEND FOR ESTIMATES.

N. E. CORNER SECOND AND LOMBARD STREETS.

ST. LOUIS, MO.

THE CLIMAX COUPLING



A NEW AND ORIGINAL INVENTION.

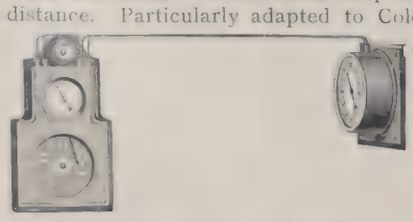
Unsurpassed for Efficiency, Strength, Durability and Economy. Investigation will establish its superiority over every other known pipe-joint, particularly for Ice and Refrigerating Plants using ammonia. For further information, testimonials, prices, etc., address

ENOCH LAWSON,

229 FULTON STREET, SAN FRANCISCO, CAL.

Telemeter Instruments.

For recording and indicating temperature and pressure at a distance. Particularly adapted to Cold Storage, to indicate in the office or engine room the temperature in any or all the refrigerating rooms.

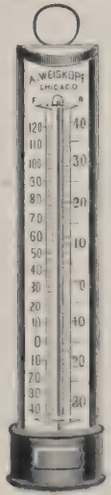


FOR DESCRIPTION AND PRICES SEND TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Courtlandt St. Boston Office, 70 Pearl St.



A. WEISKOPF

111 Fifth Ave., CHICAGO,

. . . . . MANUFACTURER AND IMPORTER OF . . . . .

THERMOMETERS AND HYDROMETERS.

Ice Machine Thermometers and Ammonia Hydrometers . . . .

CELLAR AND . . . . . CHILL ROOM THERMOMETERS.

Thermometers in angle shape made to order from sketch or specification.

ESTIMATES FURNISHED ON APPLICATION.



IMPORTANT TO ICE MAKERS.

TRI-SODIUM PHOSPHATE CHEMICAL WATER PURIFIER.

PATENTED

A staple salt for the purification of water, ***HOT*** or ***COLD***, free from injurious action to ice, water or metals.
It prevents incrustations in boilers, and yields an absolutely pure steam for condensing and freezing.
It will prevent incrustations or corrosion to cooling coils, when applied to water passing over them.

By its use the impurities are rapidly eliminated from hot or cold water, by precipitation in tanks, producing a clear, soft, wholesome water for freezing or other purposes.

Send for our book "Worth Knowing," containing valuable information on ***Water Treatment.***

KEYSTONE CHEMICAL COMPANY, Patentees and Manufacturers,

3 South Front Street, PHILADELPHIA. — 65 South Canal Street, CHICAGO.

STRONG TESTIMONY

CHAMPION ICE MANUFACTURING AND COLD STORAGE CO.

KEYSTONE CHEMICAL CO. COVINGTON, KY., June 27, 1891.

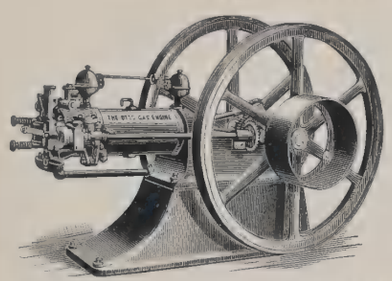
Gentlemen: In answer to your inquiry as to how we like your Tri-Sodium Phosphate, will say that we have been using it for two years with the best of results, both here and at our plant in Ironton, O. We find that it keeps our boilers clean, and the condensed steam from them is absolutely pure, and therefore does not affect the ice manufactured from it in the least. Condensed steam from boilers usually carries an insipid, smoky or bitter flavor with it into ice, but this is entirely overcome. We have the reputation of having the best artificially manufactured ice in this country; it is clear, odorless and tasteless, in fact absolutely pure, and we "bank" our last dollar on your Tri-Sodium Phosphate Yours truly,

(COPY) R. W. DUGAN, Sup't and Treas. CHAMPION ICE MFG. & COLD STORAGE CO.

OTTO

Gas and Gasoline Engines

OVER 33,000 IN USE



BEST AND CHEAPEST POWER FOR

Refrigerating Machines

No Skilled Attendance.
No Boiler, Heat or Danger.
Started at once for short or long duty.
Sizes, ½ to 100 horse-power.
Can be used in country or city.

OTTO GAS ENGINE WORKS, 33d and Walnut Sts., PHILADELPHIA. 151 Monroe St., CHICAGO.

....THE....

HEERDEGEN WATER INDICATOR

We make investigations for subterranean water and furnish reports as to the number of streams, their exact width, direction of flow, approximate depth below the surface, and quantity of flow.

The great advantage of having a well located, is:

1. We locate wells only at such places where we find subterranean FLOWING streams; this is a full guarantee of getting wells, which will never drop off or give out in time of drought, which is the case where wells are supplied by seepage water only.
2. We can follow the course of a subterranean stream for any distance and select the proper place to sink the well.
3. We state the approximate depth of the stream below the surface, which enables our customers to make an estimate of the cost for sinking the well by the foot.
4. Where the supply of an ARTESIAN WELL is obtained from a running stream or a spring, instead of seepage water, in NINE CASES OUT OF TEN IT IS OF GOOD QUALITY.
5. If there are any springs in the neighborhood where a well is wanted, we can trace the underground outlets of same or the supplying flow for any distance.
6. Where water of low temperature is wanted for cooling purposes, such as for BREWERIES, ICE FACTORIES, distilleries, oil refineries, etc., none cooler than artesian well water exists.
7. Our method of locating wells eliminates all and every risk of failure.

Estimates are given for sinking wells, with guarantee of water, where supply from artesian wells is desired.

We have successfully located a large number of wells.

For particulars apply to

HEERDEGEN & SCHNEE,

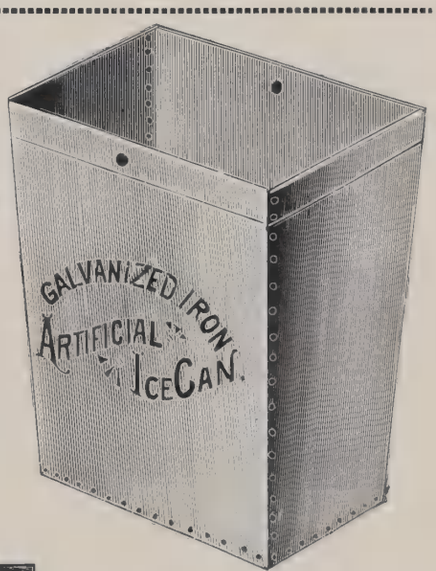
48 EXCHANGE PLACE, - - - NEW YORK.

CAPACITY 300 PER DAY.

ICE "CANS" GALVANIZED IRON

WE MAKE THEM BY THE THOUSANDS FOR ICE MFRS. BREWERS AND FOR THE TRADE READ TESTIMONIALS.

WRITE FOR PRICES



NEWBURGH, N. Y., November 20, 1890.

I desire to say that I am pleased with the Ice Cans you have furnished me and they have proved satisfactory to my customers.

ROBERT WHITEHILL,
Manufacturer of Engines and General Machinery.

DAYTON, OHIO, November 28, 1890.

The Ice Cans with which you furnished us in the summer of 1890 have been in constant use during the entire Ice Manufacturing season of 1890, giving entire satisfaction. The material and workmanship could not have been better, and to-day the cans are as good as when shipped from your factory. We can faithfully recommend your cans.

C. SCHWIND,
Dayton View Brewery.

SEE TESTIMONIALS NEXT ISSUE.



GROUND FLOOR SPACE 110X210FT.

Established 1861. Incorporated 1890.

THE

KIECHLER MFG. CO.

LINN, EVERETT and CLINTON STS.

CINCINNATI, O.

Insulating Linings

EVERY VARIETY FOR
REFRIGERATORS,
REFRIGERATOR CARS
AND COLD STORAGE.

Sectional Pipe Coverings

FOR AMMONIA AND BRINE PIPES IN ICE AND REFRIGERATING MACHINES.

SEND FOR SAMPLES AND PRICES.

H. F. WATSON CO., ERIE, PA.

NEW YORK. PHILADELPHIA. CHICAGO.

THE **B. F. GOODRICH CO.**

AKRON RUBBER WORKS,
AKRON, OHIO.

MANUFACTURERS OF

MECHANICAL RUBBER GOODS

HOSE OF HIGH QUALITY

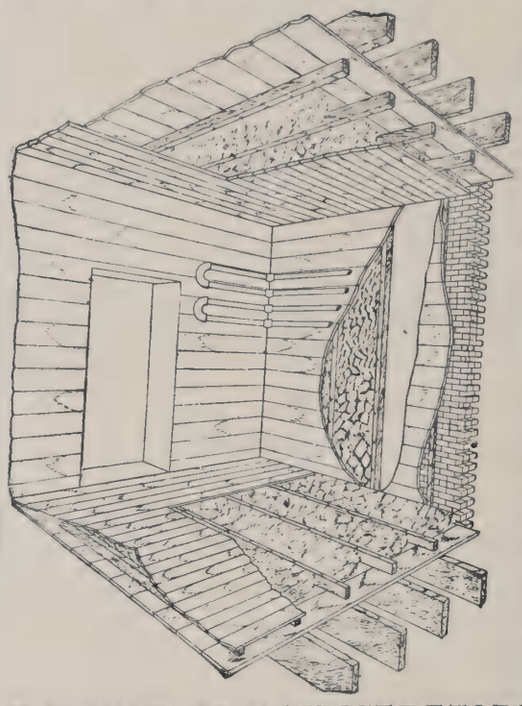
FOR
ICE FACTORIES
AND COLD STORAGES

Rubber Rings for Ice Machines of all Kinds,
Belting, Valves, Etc.

SPECIALTIES TO ORDER. Samples and Prices upon Application.

MINERAL WOOL

GOLD STORAGE, BREWERIES



INSULATION

.... ICE PLANTS REFRIGERATORS. ....

FOR FREE SAMPLE AND BOOK, ADDRESS

Western Mineral Wool Co.

CHICAGO. CLEVELAND. ST. LOUIS.



AUG. OHLSEN. JOS. MECKLER.

QUEEN CITY
Omnibus and Wagon
MFG. CO.
Builders of all Kinds of Vehicles.
Cor. Charles and Plum Sts.,
CINCINNATI, O.

HILPERT & CHANDLER

ENGRAVERS
BY ALL PROCESSES.
REFER TO CUTS IN THIS PAPER FOR SPECIMENS OF WORK.
167 DEARBORN ST. CHICAGO.

WRITE FOR SAMPLES AND FULL PARTICULARS ON

NEPONSET WATER-PROOF FABRICS



POSITIVELY THE

BEST INSULATING MATERIAL

FOR

COLD STORAGE
AND REFRIGERATOR CARS.

IN FACT ALL REFRIGERATION.

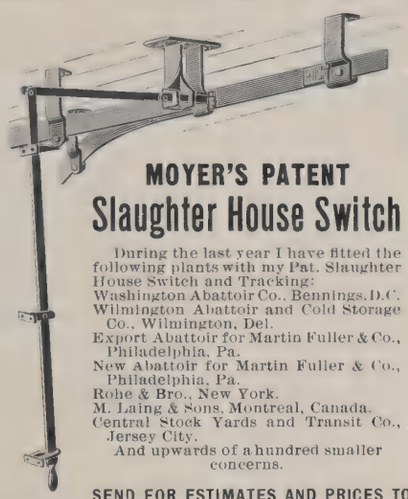
F. W. BIRD & SON, Sole Manufacturers, East Walpole, Mass.

Mineral Wool

BEST INSULATOR FOR .....

ICE HOUSES,
COLD STORAGE ROOMS,
ETC.

SAMPLES FREE ..... **U. S. MINERAL WOOL CO.** 2 CORTLANDT ST., N. Y. CITY.



MOYER'S PATENT

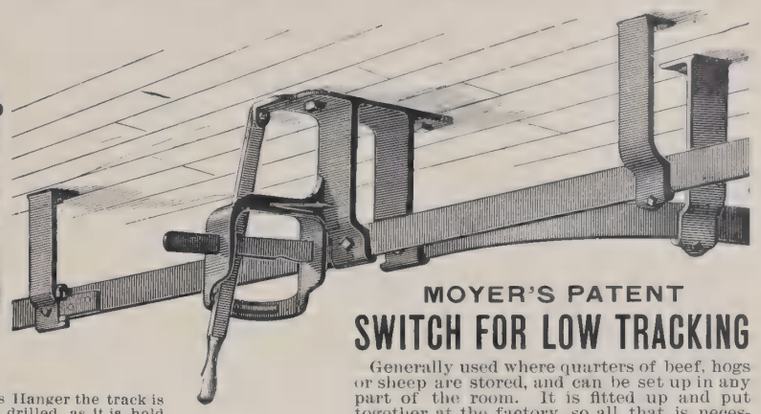
Slaughter House Switch

During the last year I have fitted the following plants with my Pat. Slaughter House Switch and Tracking:
Washington Abattoir Co., Bennings, D.C.
Wilmington Abattoir and Cold Storage Co., Wilmington, Del.
Export Abattoir for Martin Fuller & Co., Philadelphia, Pa.
New Abattoir for Martin Fuller & Co., Philadelphia, Pa.
Rohe & Bro., New York.
M. Laing & Sons, Montreal, Canada.
Central Stock Yards and Transit Co., Jersey City.
And upwards of a hundred smaller concerns.



MOYER'S Patent Hanger

When using this Hanger the track is not required to be drilled, as it is held in position by a clamp bolt, thereby saving the cost of drilling. It affords a cheap and simple manner of erecting the tracking.

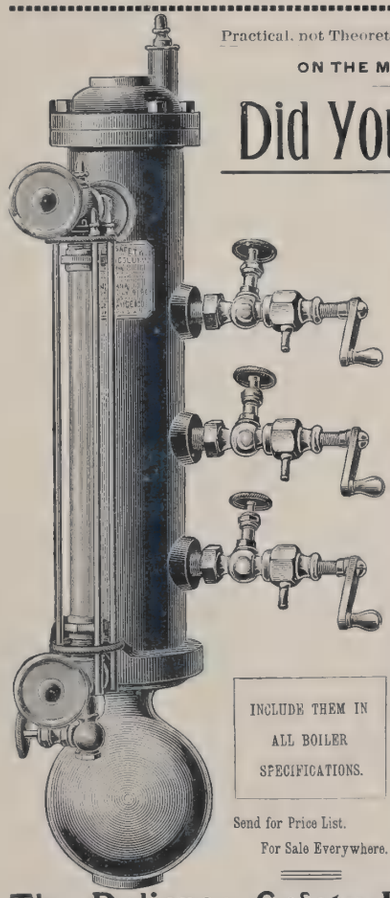


MOYER'S PATENT

SWITCH FOR LOW TRACKING

Generally used where quarters of beef, hogs or sheep are stored, and can be set up in any part of the room. It is fitted up and put together at the factory, so all that is necessary to erect it is to fasten the hanger to the ceiling and the switch is ready for use. This can be done in twenty minutes.

SEND FOR ESTIMATES AND PRICES TO **J. W. MOYER, 14 Broad Street, Philadelphia, Pa.**



Practical, not Theoretical . . Over 15,000 in daily use.

ON THE MARKET SINCE 1884.

Did You Ever Stop

to think what
it means
to have the water
carried uniformly
at
the proper level?

IT MEANS
safety,
saving of fuel,
steady power,
and
more of it,
no leaky tubes,
no burned boilers,
no stoppage
for expensive repairs.

ALL
of
which

YOU CAN
secure
for
merely
nominal cost,

BY USING

INCLUDE THEM IN ALL BOILER SPECIFICATIONS.

Send for Price List.
For Sale Everywhere.

The Reliance Safety Water Columns.

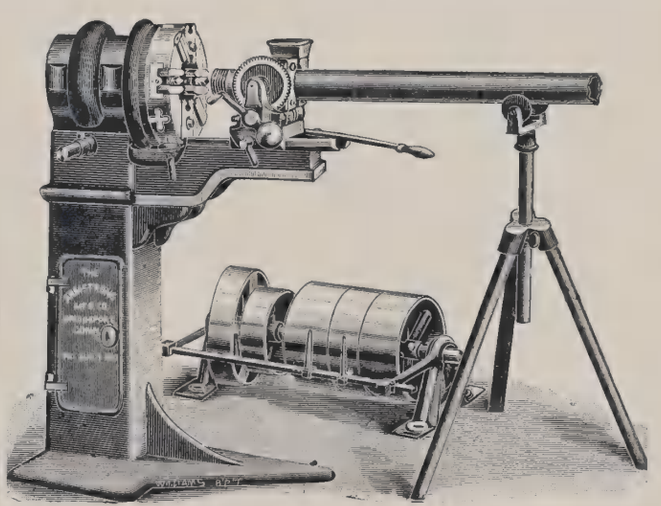
THE RELIANCE GAUGE CO.
101 EUCLID AVE., CLEVELAND, O.

ARMSTRONG MAN'F'G. CO.



WATER GAS AND STEAM FITTERS TOOLS

BRIDGEPORT, CONN.



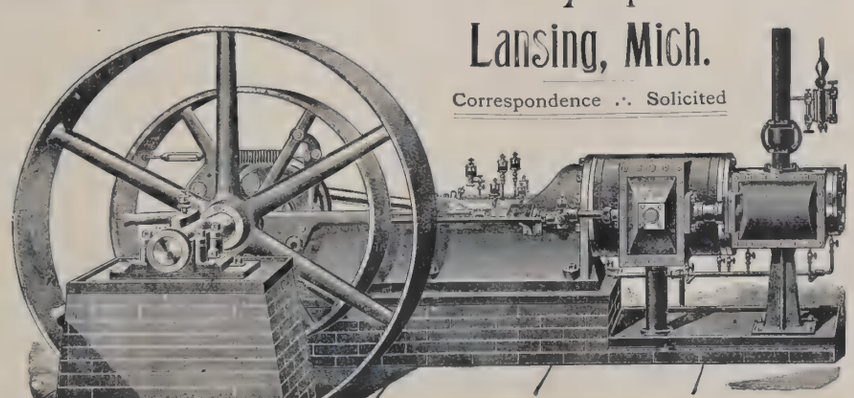
Acknowledged to be the Best, as attested by Hundreds of Letters from parties having them in use, on file in our office.

CATALOGUES FREE ON APPLICATION.

LANSING IRON AND ENGINE WORKS

Lansing, Mich.

Correspondence .·. Solicited



[BACK VIEW TANDEM COMPOUND ENGINE, MADE BY THE LANSING IRON AND ENGINE WORKS.]

MANUFACTURERS OF

COMPOUND
CONDENSING
AUTOMATIC

ENGINES

Boiler, Sheet Iron and Tank Work for Ice Factories and Cold Storage Plants a Specialty . . . . . .



THE CHEF.

McCray Refrigerator AND Cold Storage Co.

KENDALLVILLE, IND.

MANUFACTURERS AND BUILDERS
OF ALL KINDS OF

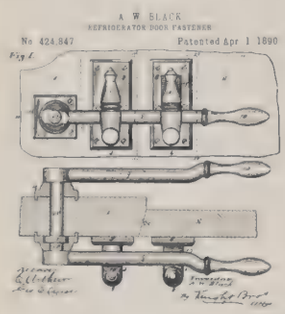
REFRIGERATORS AND COOLING ROOMS

WRITE FOR CATALOGUE AND PRICES.

Special Attention for Ice Cold Storage Buildings.

CHICAGO OFFICE,
Loomis Building, Clark and South Water Streets.

BLACK'S LATEST IMPROVED . . .



Refrigerator Door Fastener

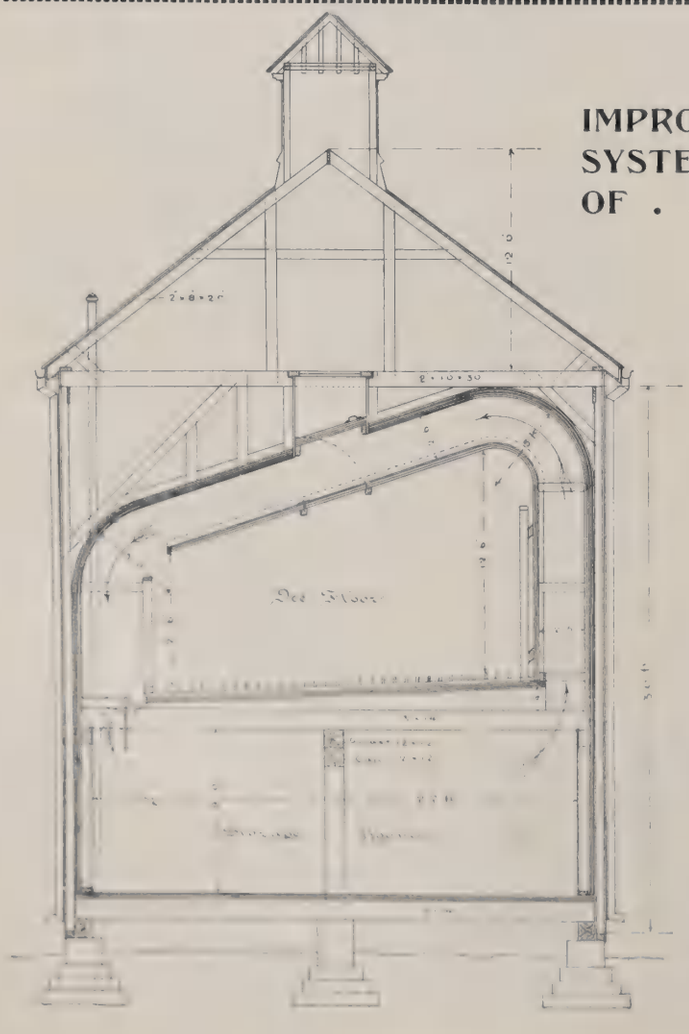
FOR HEAVY DOORS.

ONLY ONE QUALITY MADE, THE VERY BEST BRIGHT BRONZE.

Operates from both sides of door.

NEVER GETS OUT OF ORDER.
SENT BY EXPRESS ON RECEIPT OF $12.

A. W. BLACK, St. Louis, Mo.



BLACK'S

IMPROVED SYSTEM . OF . . . .

Cold Storage

.....FOR.....

BEEF AND PORK PACKERS,

Creameries, Cheese Factories,
Fruit and Produce Dealers.

ABSOLUTELY DRY AIR,
AN EVEN TEMPERATURE,
PERFECT CIRCULATION,
NO SWEATING.

CAN BE COOLED BY ICE OR MACHINE.

Used in preference to all other systems by the ARMOUR PACKING CO., the leading beef and pork packers of America. A saving of 30 per cent in ice over other systems.

WRITE FOR PARTICULARS.

Plans and specifications furnished parties who have their Builder.

A. W. BLACK, St. Louis, Mo.

AUG. MARITZEN,

Engineer and Architect

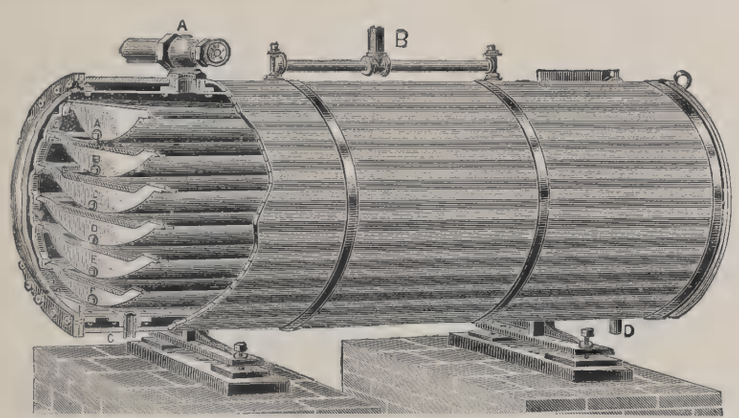
WILL FURNISH ON SHORT NOTICE
ALL PLANS, SPECIFICATIONS AND
ESTIMATES FOR COMPLETE . .

COLD STORAGE HOUSES,
ICE FACTORIES,
ICE HOUSES,
BREWERIES, MALT HOUSES,
GRAIN ELEVATORS,
WAREHOUSES,
DISTILLERIES,
ENGINE AND BOILER HOUSES,
ETC., OR ANY OF THEIR SPECIAL PARTS.

And also for Remodeling and Improvements in Old Buildings, Etc.

BEST OF REFERENCES FURNISHED AND
SATISFACTION GUARANTEED. . . . .

ROOMS 40, 42, 44, 46, 48, No. 177 LA SALLE STREET,
CORNER MONROE,
Chicago, Ill.



HOPPES LIVE STEAM PURIFIER.

THE
"HOPPES"
Live Steam Feed-Water
PURIFIER

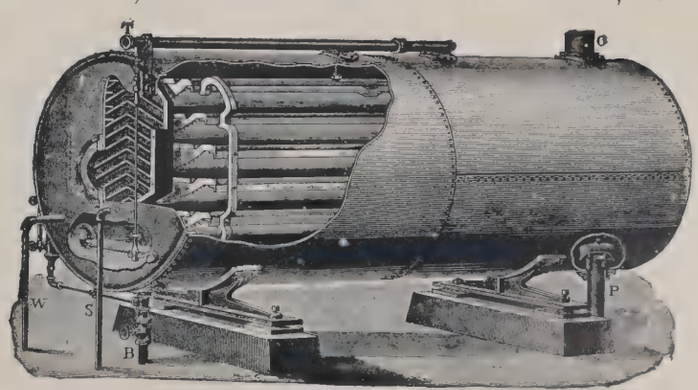
Is especially adapted to ICE MAKING PLANTS, as pure water is essential to insure a good quality of ICE. The use of the HOPPES PURIFIER will insure you pure water, by removing all of the impurities therefrom, at the same time keeping your boilers clean and free from scale without the use of boiler compounds or scale solvents.

CATALOGUES, ESTIMATES, SPECIFICATIONS, ETC., CHEERFULLY FURNISHED.

THE HOPPES MFG. CO., SPRINGFIELD, O.

IF YOU WANT TO GET THE FULL BENEFIT
OF YOUR EXHAUST STEAM,
INVESTIGATE THE

"HOPPES"
Exhaust Steam Feed-Water
HEATER

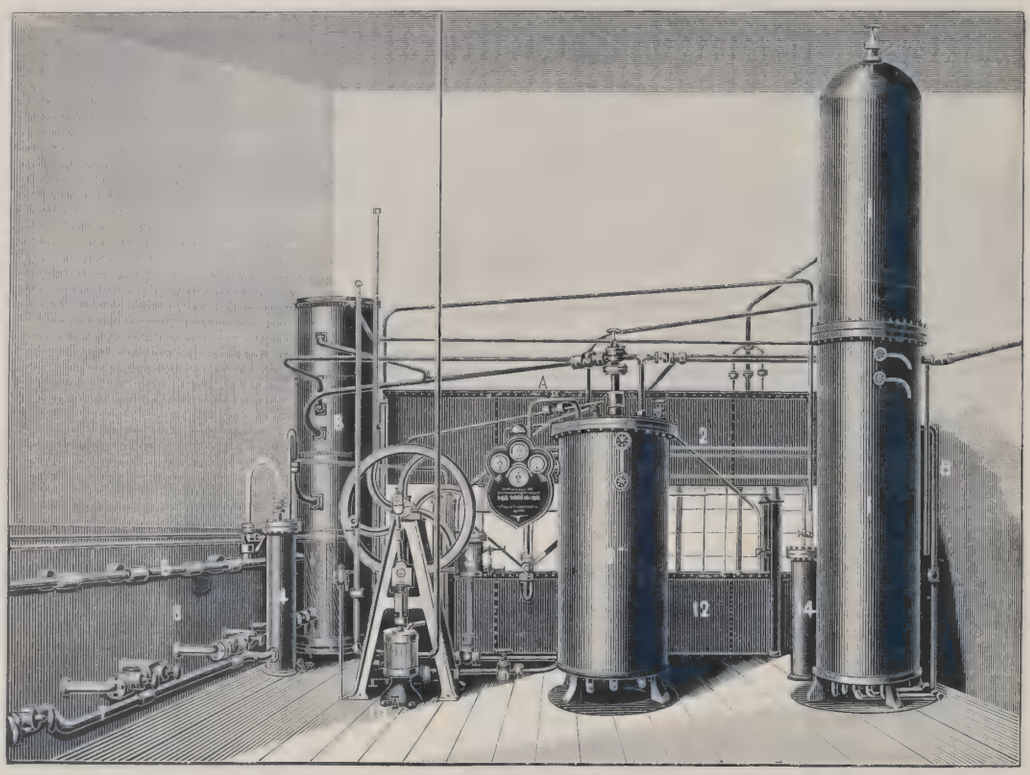


HOPPES EXHAUST HEATER

COLUMBUS IRON WORKS

IMPROVED

Absorption Ice Machine



SUCCESSORS TO
H. D. STRATTON & CO.

Established 1853.
Incorporated 1856.

W. R. BROWN, President.
W. COOK, Superintendent.

Machines from 5 to 33 tons capacity per 24 hours, or larger if desired.

94 Machines Built
and all in successful operation

More Ice Making Machines sold in the South than by any other establishment.

No expensive building required. No pressure on machine when stopped.

Send for price list and illustrated circular with location of machines.

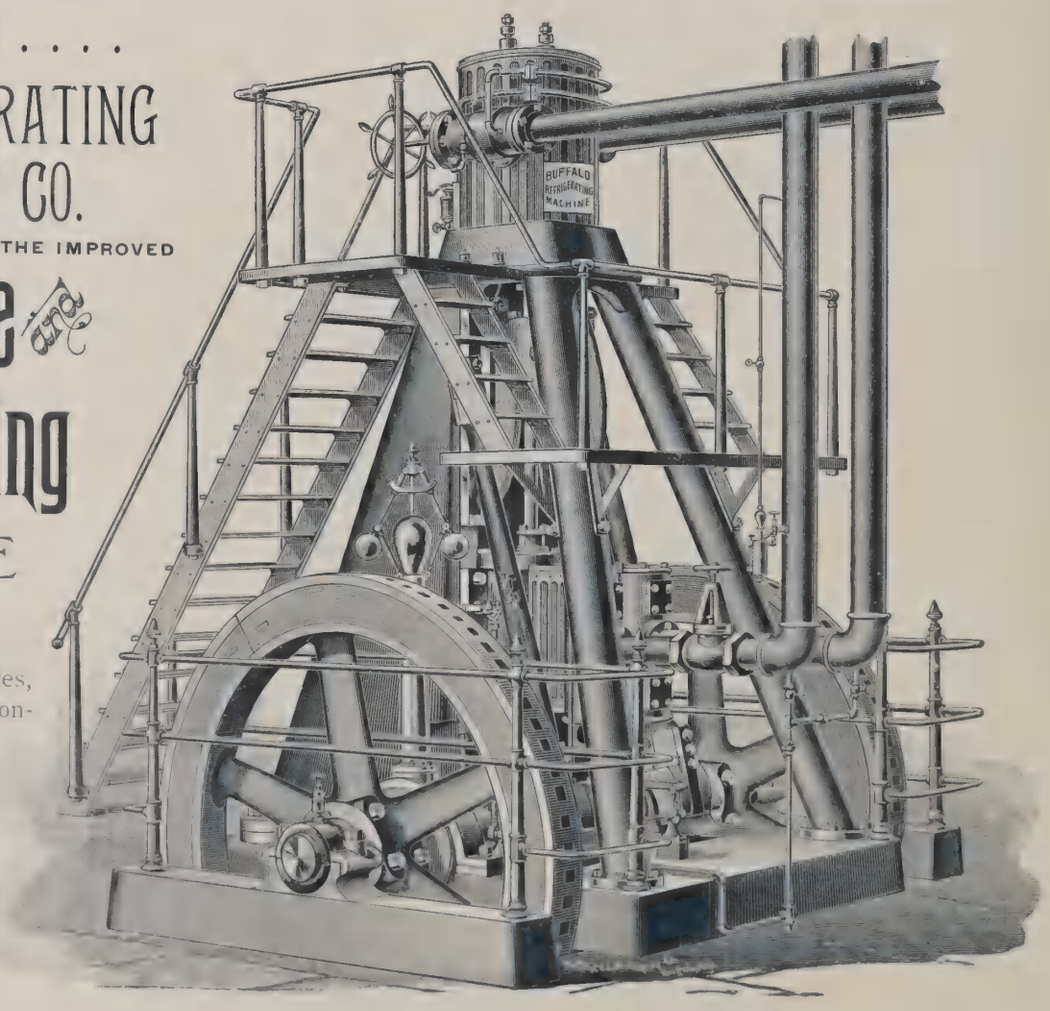
This establishment was the first to turn out a perfect and complete Ice Machine, and has been in the business 21 years, constantly manufacturing and improving, and are prepared to furnish the most reliable and economical machine in the market.

BUILT BY THE . . . **COLUMBUS IRON WORKS CO.** COLUMBUS, GA.

BUFFALO .... REFRIGERATING MACHINE CO.

BUILDERS OF THE IMPROVED

Buffalo Ice and Refrigerating MACHINE



Full particulars, estimates, Illustrated Circular, containing list of machines in use, etc., furnished upon application.

Buffalo, N. Y.

The Improved Pontifex-Wood Machine

A MOST ECONOMICAL AND RELIABLE APPARATUS,

Adapted to all classes of Refrigeration, especially where extremely low temperatures are required.

ALSO FOR

MAKING . . . ICE

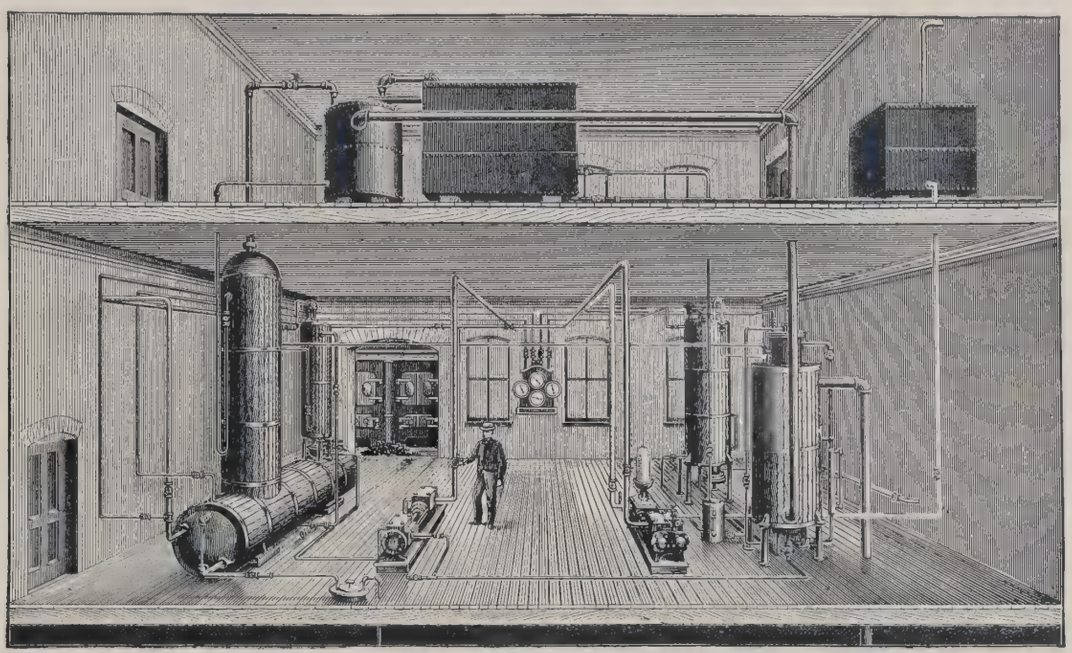
UPWARDS OF

400

MACHINES IN OPERATION.

H. J. W. S. COOKE,
Patentee.

ESTIMATES FURNISHED.
SEND FOR CIRCULARS.



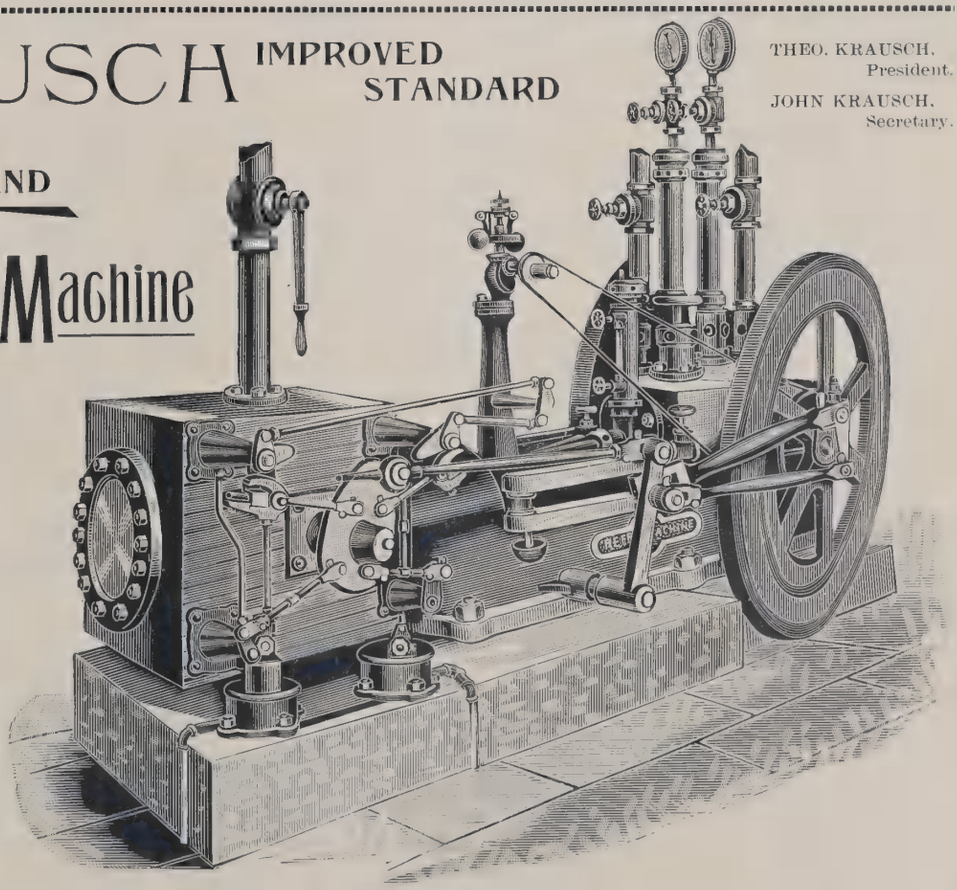
ISBELL-PORTER COMPANY, BUILDERS,

OFFICES

245 BROADWAY, NEW YORK. 46 BRIDGE STREET, NEWARK, N. J.

THE KRAUSCH IMPROVED STANDARD ICE AND Refrigeration Machine

THEO. KRAUSCH, President.
JOHN KRAUSCH, Secretary.



Is original, horizontal, simple, strong, double acting, central, and is provided with the Corliss Valve Gear. It is most economical in fuel, water and space. Its refrigeration capacity is unsurpassed. Machines are in operation for 10 years without need of repairs, but ordinary wear and tear.

Our machines are guaranteed for years. Plants are erected for Packing Houses, Breweries, Oil Refineries, Cold Storage, Market Houses, Butcher Shops, Hotels and Ice Making.

PRICES ARE MODERATE.

ALL KINDS
ARCHITECTURAL PLANS
FURNISHED.

THE THEO. KRAUSCH CO.

122 E. UTICA STREET, BUFFALO, NEW YORK.

THE PONTIFEX ICE MACHINE COMPANY,

ROBERT HEWITT, President, 512 West Street, NEW YORK CITY,

ARE PREPARED TO CONTRACT FOR

Ice and Refrigerating Plants of any magnitude, under the Reece, Stanley, Pontifex-Wood and Hendrick systems Refrigerant, Aqua Ammonia as constructed under special arrangement with this Company by

THE HENDRICK MANUFACTURING COMPANY, LIMITED, CARBONDALE, PA.

The **PONTIFEX-HENDRICK** Ice and Refrigerating Machine is the result of more than fifteen years' experience in such work on the part of Messrs. Pontifex and Wood, Farrington Works, London, the original builders of the machine in Great Britain and its Colonies, and of the Pontifex Ice Machine Company, American builders, who have somewhat modified the machine to better adapt it for American refrigerating practice. **A Simple, Strong, Durable, Reliable, Economical and Efficient Machine,** particularly adapted for low temperature work, such as the refrigeration of Paraffine Works, Oil Refineries, Freezing and Cold Storage Warehouses, Fish Freezing Houses, Chemical Works, etc. In successful use in **47 Ice Factories** in tropical countries. Over **350** machines in successful operation in Freezing and Cold Storage Warehouses, Breweries, Distilleries, Wineries, Packing Houses, Abattoirs, Dressed Beef Houses and Markets, Dairies and Creameries, Butterine Factories, Yeast Factories, Chocolate and Candy Factories, Hotels and Restaurants, Paraffine and Cotton Seed Oil Refineries, Lard Refineries, Powder and Dynamite Mills. Machines built from **2½** to **100** tons daily refrigerating capacity. Machines guaranteed for material, workmanship and capacity under test. For descriptive circulars, references, detailed specifications, apply either to

THE PONTIFEX ICE MACHINE COMPANY, 512 West Street, NEW YORK.

OR

THE HENDRICK MANUFACTURING CO., Ltd. CARBONDALE, PA.

CASTLE ICE MACHINERY CO.

MANUFACTURERS OF INDIANAPOLIS, IND.

Absorption Ice and Refrigerating Machines

For all purposes, containing latest improvements, making REGULAR that which before was NOT regular. Our 15-ton Absorber contains over 6,000 square feet of absorbing surfaces, enabling the temperature of absorption to vary from 50 to 110 deg. Fahr. without affecting operations. One foundation for all machinery. Small water consumption. Economical and positive. The machines in use: We refer to Seymour Ice Co. (Ind.) having machine with all improvements.

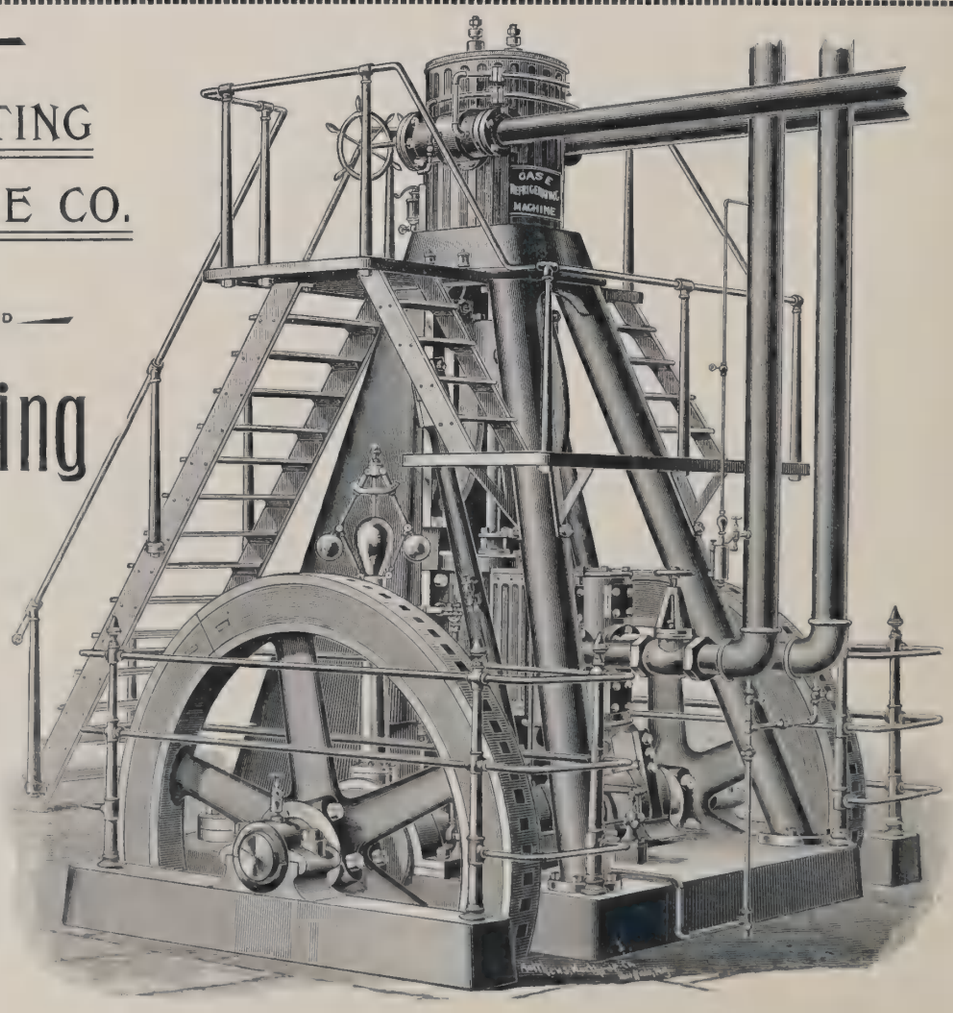
MAKE YOUR EXHAUST STEAM PRODUCE SILVER DOLLARS

By using it through our New Designed Machine with improvements for Refrigerating, Cold Storage or Ice Making, from 50 lbs. to 3 tons. Using either live or exhaust steam. With non-explosive retort. Automatic. Can be arranged to operate 12 hours each day and perform excellent duty. No extra help required.

CIRCULARS AND ESTIMATES ON APPLICATION.

THE CASE REFRIGERATING MACHINE CO.

BUILDERS OF ICE AND Refrigerating ..MACHINES.. FOR ICE MAKING AND ARTIFICIAL REFRIGERATING



Full particulars, Estimates, Illustrated Circular, containing list of machines in use, etc., furnished upon application.

BUFFALO, N. Y.

JOHNSON,

McCARTHY

& JOHNSON,

MANUFACTURERS OF

THE JOHNSON COMPOUND

Ammonia Compressor

—AND—

ICE AND REFRIGERATING MACHINES . . . . .

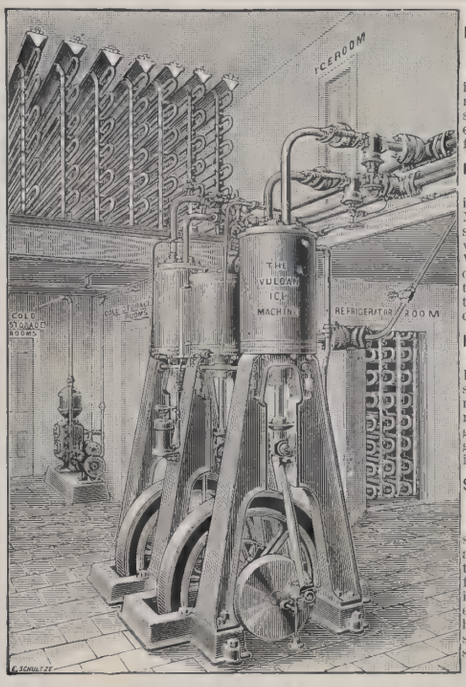
Office, Room 76, Worcester Block,

PORTLAND, OREGON.

THE VULCAN

Ice and . . . . .

Refrigerating Machine



Enterprise Brewery, San Francisco:
"The 25-ton Refrigerating Machine has been running continuously since 1887, and has proved economical and satisfactory in every respect"

Hotel Del Monte, Mont'y:
"The Ice Machine now in operation at Hotel Del Monte is and has been since its completion a very satisfactory plant. We take pleasure in cordially recommending this variety of machine to any one who may require its use."

Hotel Rafael, San Rafael:
"The 'Vulcan' Ice and Refrigerating plant is satisfactory in every respect, and is doing more work than was guaranteed. A model of good workmanship. The ice is clear."

South San Francisco Packing and Prov. Co.:
"It gives us pleasure to state that the Refrigerating plant furnished by the Vulcan Iron Works for our packing house, in 1886, has been in operation since then, and has given the best results, to our complete satisfaction."

THE VULCAN IRON WORKS,

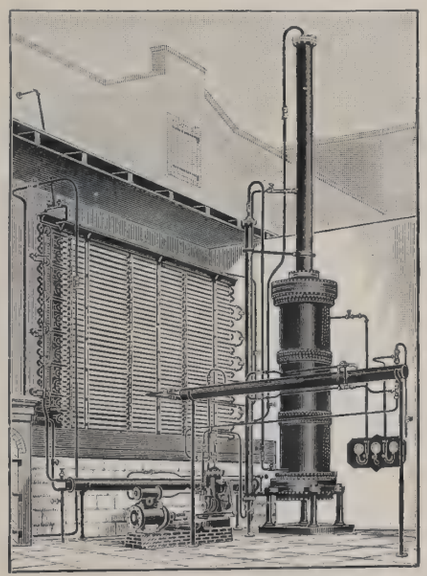
135-145 Fremont Street, SAN FRANCISCO, CAL.

PENNSYLVANIA IRON WORKS COMPANY,

.....MANUFACTURERS OF ....

Ice and Refrigerating Machines

EMBODYING THE LATEST IMPROVEMENTS IN ABSORPTION MACHINES.



Ice Machine References

W. H. RAGAN, Thibodaux, La.
HENRY COOK, Donaldsville, La.
GEO. & J. G. MUEHLEBACH, Kansas City, Mo.
LAUER BREWING CO., Reading, Pa.
STEGMAIER & SON, Wilkes Barre, Pa.
J. H. MICHENER & CO., Philadelphia, Pa.
EDSON BROS. Cold Storage, Philadelphia, Pa.
"GLADSTONE" APARTMENTS, Philadelphia, Pa.
THOS. BRADLEY, Cold Storage, Philadelphia, Pa.
FRAISSI & BLUM, Ice Manuf'rs, Houma, La.

AND MANY OTHERS.

SATISFACTION AT LOWEST COST GUARANTEED.

Plans and estimates for plants erected ready for operation cheerfully given on application.

Office and Works, 50th Street and Merion Avenue,

PHILADELPHIA, PA.

NEW YORK OFFICES, 9 AND 11 WALL STREET.

THE CRAFT REFRIGERATING MACHINE CO.

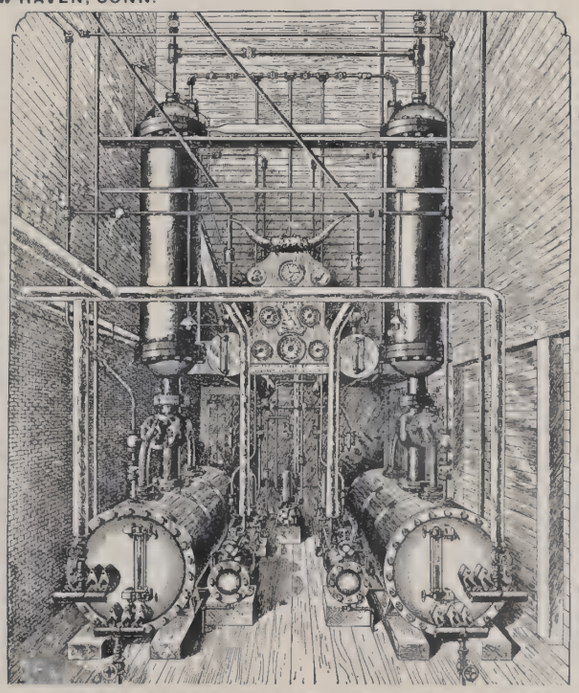
JAMES B. CRAFT, Prest.
H. B. BIGELOW, Treas.
GEORGE S. BARNUM, Sec'y.

No. 15 Cortlandt Street, NEW YORK,

FACTORY, NEW HAVEN, CONN.

....MANUFACTURERS OF....

Descriptive Circulars, References, Detailed Estimates and Information Furnished on Application.



Brewers, Pork Packers, Oil Refiners, Cold Air Store Houses, and all Purposes where a low degree of temperature is required.

ICE AND REFRIGERATING MACHINES FOR ICE MAKING PLANTS.

THE WESTERN ICE MACHINE CO.

OTTO HOFFMANN, PROPRIETOR.

Ice AND Refrigerating Machinery

FOR BREWERIES, PACKING HOUSES, ICE FACTORIES,
COLD STORAGE PLANTS, MARKETS, CONFECTIONERS, ETC.

Every Part Accessible While in Motion. . . . . .
The Most Cooling with the Least Expense. . . . .

THIS machine is the simplest, cheapest in first cost and after expense, is more easily handled than any other, and takes less room. Absolutely no possibility of leaking Ammonia. Machines of any capacity from smallest to the largest. We would be pleased to make Estimates, and believe we can show you a saving in cooling your cellars. . . . . .

WESTERN ICE MACHINE CO.

Office, Room 605 Northern Office Building, Cor. La Salle and Lake Sts.,

See this space next issue for Illustration of Machine.

CHICAGO, ILL.

ICE MACHINES

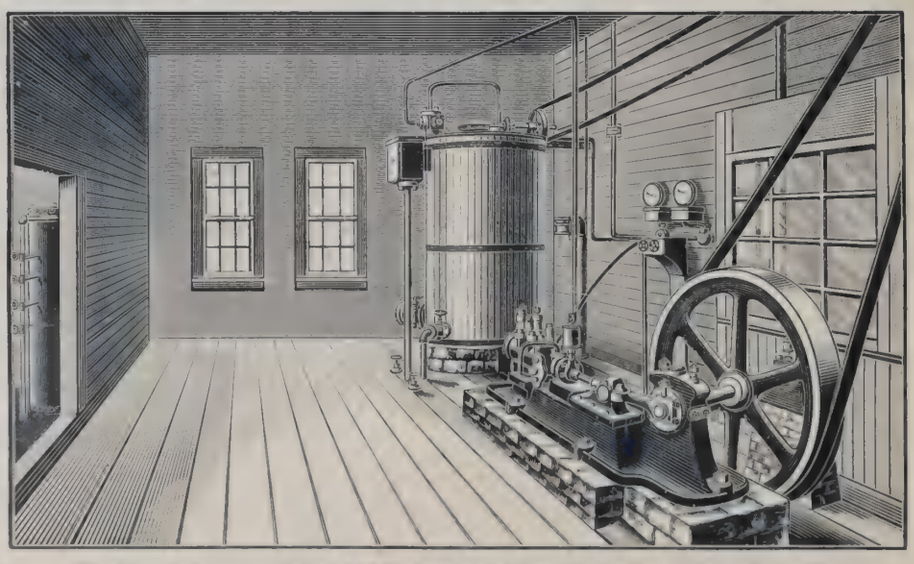
(WINDHAUSEN'S SYSTEM.)

AINSLIE, COCHRAN & CO.

LOUISVILLE, KY.

To the Trade . . . .

We have recently secured the sole right to manufacture and sell WINDHAUSEN'S CARBONIC ANHYDRIDE ICE AND REFRIGERATING MACHINES in the United States. These machines have gained a wide reputation on the continent for their simplicity, durability and economical running. They have been indorsed by the German government, an eighty [illegible] ton machine having been placed in the powder works at Spandau. They are also fast superseding other systems in the prominent breweries of Germany, nearly 200 being in operation already. They are the only machines using carbonic anhydride, which has such a great range of expansion, produces such intense cold, and is cheap, odorless and easily obtained.



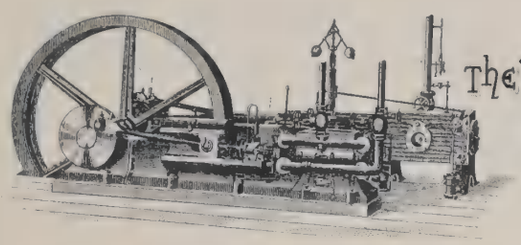
The above cut represents the No. 2 Machine at the Terre Haute House, Terre Haute, Ind.

WRITE TO US FOR FURTHER PARTICULARS

AINSLIE, COCHRAN & CO.

REFRIGERATING PLANTS

THEO. O. VILTER, Prest. & Supt.
ALBERT WALLBER, Vice Prest.
WM. O. VILTER, Secy. & Treas.



The Weisel & Vilter Mfg. Co.

Manufacturers of

CORLISS ENGINES,
Machinery for Brewers and Bottlers.

ICE MAKING & REFRIGERATING MACHINERY.

ICE-MAKING PLANTS

FOR BREWERIES, PACKING HOUSES, CONFECTIONERIES, COLD STORAGE HOUSES, ETC.

Direct Expansion or Brine System

MILWAUKEE, WIS.

Van Winkle Gin & Machinery Co.

E. VAN WINKLE, President.
J. WALLACE BOYD, Secretary.

MANUFACTURERS OF

THE KEELING .. AUTOMATIC .. ICE MACHINE

FOR ICE MAKING, COLD STORAGE PLANTS, BREWERIES, PACKERS, ETC.

WRITE FOR ESTIMATES AND FURTHER INFORMATION.

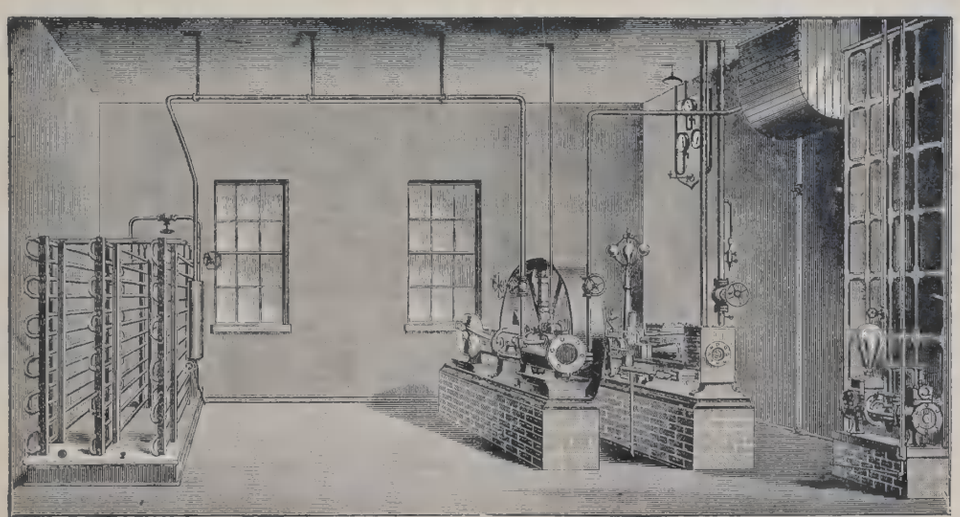
VAN WINKLE GIN AND MACHINERY CO.

OFFICE, 210 MARIETTA STREET, ATLANTA, GA.

The American Ice Machine Company

SOLE OWNERS OF THE
KLINE AND WINKLER AUTOMATIC

REFRIGERATING AND ICE MAKING MACHINE SYSTEM



Simplicity of Construction,
Durability,
Efficiency,
Economy.

ICE-MAKING OR REFRIGERATING PLANTS

From One Ton to Two Hundred Tons daily capacity.

Over 100 MACHINES IN OPERATION.

1. **The simplicity of construction.** Every part is simple and complete, is exposed to full view, easily got at and can be readily understood and handled by an engineer of ordinary intelligence.

2. **The freezing process is completely automatic** (WHICH NO OTHER FREEZING SYSTEM POSSESSES), through the action of our patent evaporation pressure regulator; it saves valuable working time. Every part is independent of the other, and can be overhauled or replaced without stopping the whole machine.

3. **That ice is manufactured from distilled water,** which is free from disease-producing germs, such as abound in ice frozen on rivers and ponds, is chemically pure, and is infinitely preferable to the natural product.

4. **Our Patent Gas Condenser enables us to work with warmer water and less water** than any other machine, as the water is applied DIRECT on the hot pipe without waste or slop on the surroundings.

5. **We can make more ice or cold air** than any other machine, WITH THE SAME AMOUNT OF FUEL. Experts have placed the difference in our favor at not less than 25 per cent.

6. **The Condensers and Freezers** will not stop on account of sediment. They never require cleaning. They clean themselves while at work without separate attachment. Our freezing coils are so constructed that no pipe joint is used inside of the tank, and each coil is independent of the other. Each coil section can be taken out while working without interference with the other sections.

Company's Offices, 35 Broadway, Rooms 72, 73, 74 and 75, New York.

THIS ENGRAVING REPRESENTS THE WORKS OF THE

Blymyer Ice Machine Co., Cincinnati, Ohio.

Manufacturers of Ice and Refrigerating Machines, exclusively. The Absorption Machine, made by the Blymyer Ice Machine Co., is superior to any Compression Machine, either as a Refrigerating or Ice-Making Machine. It requires no steam engine or complex moving machinery. It saves 25 to 40 per cent of the fuel, and saves ammonia and labor. The cost of repairs is small, and the machine will outlast Compression Machines several times over. It is not necessary to buy these machines in pairs, as there is no danger of serious stoppage. These machines are ***RADICALLY DIFFERENT*** from all other Absorption Machines, and are in every way superior to them.



BELOW will be found a list of Ice-Making and Refrigerating Machines made by us. Every one of these machines has been in continuous use since erected, and is in use now. None have failed to fill their guarantees satisfactorily; none have been superseded by other machines. The entire capacity of our works having, up to the present time, been taken up with the manufacture of Ice-Making Machines, no agents have solicited orders for Refrigerators. Such orders as have been taken have been merely incidental. Having easily taken the lead in the Ice-Making Machine field, the manufacturers, with their enlarged capacity, will now enter the Refrigerator field (which is much the easier of the two in which to make a good record) in earnest, and respectfully solicit correspondence. Send for our catalogue.

ICE-MAKING MACHINES.

No.	Size.	NAME.	ADDRESS.
1	8 Ton.	Meridian Ice Mfg. Co.	Meridian, Miss.
1	10 "	Baton Rouge Ice Mfg. Co.	Baton Rouge, La.
1	15 "	Evansville Ice and Cold Storage Co	Evansville, Ind.
1	5 "	A. Moresi	Jeanerette, La.
1	15 "	Lookout Ice and Cold Storage Co.	Chattanooga, Tenn.
1	10 "	Morris Ice Co.	Jackson, Miss.
1	15 "	Texarkana Ice Co.	Texarkana, Tex.
1	30 "	Lookout Ice & Cld. Stor. Co. (2d Order)	Chattanooga, Tenn.
1	5 "	Gadsden Ice Co.	Gadsden, Ala.
1	6 "	Sheffield Ice Co.	Sheffield, Ala.
1	5 "	Decatur Ice Co.	Decatur, Ala.
1	30 "	Crystal Ice Co.	Wichita, Kan.
1	3 "	Denton Ice Co.	Denton, Tex.
1	5 "	Van Buren Ice and Coal Co.	Van Buren, Ark.
1	5 "	Biloxi Artesian Ice Mfg. Co.	Biloxi, Miss.
1	25 "	Hutchinson Ice Mfg. Co.	Hutchinson, Kan.
1	12 "	Parkersburg Ice Co.	Parkersburg, W.Va.
1	30 "	Union Ice Co.	Denver, Col.
1	3 "	Dominick & Karston.	West Point, Miss.
1	3 "	DeCoppet Ice Co.	Somerset, Ky.
1	35 "	Evansv'le Ice & Cld.Stor.Co.(2d Order)	Evansville, Ind.
1	2 "	Van Horn & Chambers.	Lebanon, Ohio.
1	4 "	John C. Webb	Demopolis, Ala.
1	12 "	Huntington Ice and Storage Co.	Huntington, W.Va.
1	15 "	Corryville Artificial Ice Co.	Cincinnati, Ohio.
1	3 "	Tupelo Ice Co.	Tupelo, Miss.
1	30 "	Wheeling Ice and Storage Co.	Wheeling, W.Va.
*1	10 "	Ft. Payne Ice and Cold Storage Co.	Ft. Payne, Ala.
*1	10 "	Coronado Beach Co. (Hotel del Coronado)	San Diego, Cal.
*1	1 "	Walter Aiken (Hamilton Hotel)	Hamilton, Bermuda
*1	20 "	Decatur Cold Storage and Ice Co.	Decatur, Ill.
*1	12 "	Marietta Ice Co.	Marietta, O.
*1	35 "	Dayton Ice Mfg. & Cold Storage Co	Dayton, O.
*1	30 "	Zanesville Artificial Ice Co.	Zanesville, O.
*1	15 "	Evansv'le Ice & Cld.Stor.Co.(3d Order	Evansville, Ind.
*1	5 "	Connolly & Curtis.	Columbus, Miss.
*1	5 "	Lebanon Artificial Ice Co.	Lebanon, Ky.
*1	5 "	Cynthiana Elec. Light & Power Co	Cynthiana, Ky.
*1	5 "	Grenada Cream'y, Cld. Stor. & Ice. Co	Grenada, Miss.
*1	15 "	Washington Ice Co.	Washington, Ind.
*1	30 "	Wheeling Ice & Storage Co. (2d Order)	Wheeling, W.Va.
*1	32 "	Consumers Ice Co.	San Francisco, Cal.
*1	15 "	Shelbyville Artificial Ice Co.	Shelbyville, Ind.
*1	30 "	Pueblo Distilled Water Ice and Cold Storage Co.	Pueblo, Col.
*1	15 "	Skinner & Olson	Topeka, Kan.
*1	35 "	Fort Wayne Artificial Ice Co.	Fort Wayne, Ind.
*1	35 "	Evansv'le Ice & Cd.Stor.Co. (4th Order)	Evansville, Ind.
*1	25 "	Dayton Ice Mfg. & Cd. Sto. Co. (2d Order	Dayton, O.
*1	15 "	Ashland Artificial Ice Co.	Ashland, Ky.
*1	50 "	Corryville Artificial Ice Co. (2d Order	Cincinnati, O.

* These machines were erected in 1890.

ICE-MAKING MACHINES.

No.	Size.	NAME.	ADDRESS.
**1	8 Ton.	Gibson House	Cincinnati, O.
**1	10 "	Palace Hotel	San Francisco, Cal.
**1	30 "	The People's Ice Co.	Birmingham, Ala.
**1	35 "	Citizens Ice Co.	Los Angeles, Cal.
**1	20 "	Civill & White	Colorado Spr'gs, Col.
**1	30 "	Pueblo D.W. Ice & Cd.S.Co. (2d Order)	Pueblo, Col.
**1	60 "	Colorado Ice and Storage Co.	Denver, Col.
**1	25 "	E. B. Cornell	Tampa, Fla.
**1	5 "	Mr. H. G. Meumann	Bessemer, Ala.
**1	20 "	Consumers Ice Co.	Vicksburg, Miss.
**1	35 "	Artificial Ice and Storage Co.	Canton, O.
**1	12½ "	Frigid Ice Mfg. Co.	Joplin, Mo.
**1	30 "	Crystal Ice Co.	Albuquerque, N. M.
**1	15 "	Meridian Ice Co. (2d Order)	Meridian, Miss.
**1	5 "	Dayton Ice Co.	Dayton, Tenn.
**1	15 "	Decatur Ice Co. (2d Order)	Decatur, Ala.
**1	12½ "	The Ruddick Artificial Ice Co.	Columbus, Ind.
**1	10 "	Mr. August Erath	New Iberia, La.
**1	55 "	The Crystal Ice Mfg. & Cd. Sto. Co.	Columbus, O.
**1	32 "	Consumers Ice Co. (2d Order)	San Francisco, Cal.
**1	15 "	Peru Ice and Cold Storage Co.	Peru, Ind.
**1	55 "	The Crystal Ice Mfg. and Cd. Stor. Co. (2d Order)	Columbus, O.
**1	32 "	Lafayette Artificial Ice Co.	Lafayette, Ind.
**1	50 "	R. T. McDonald & Judah Hart	New Orleans, La.
**1	12 "	John Hoey (Hollywood Hotel)	Long Branch, N. J.
**1	15 "	Bridgeport Electric and Ice Co.	Bridgeport, Ala.
**1	5 "	Fleischman & Co.	Cincinnati, O.

** These machines were erected in season 1891.

REFRIGERATING MACHINES.

2	50 Ton.	Louisiana Brewing Co.	New Orleans, La.
1	40 "	Toledo Brewing and Malting Co.	Toledo, O.
1	40 "	Hudepohl & Kotte (Brewery)	Cincinnati, O.
1	50 "	Savannah Brewing Co.	Savannah, Ga.
1	25 "	Schantz & Schwind (Brewery)	Dayton, O.
1	15 "	John Smith's Sons (Brewery)	Youngstown, O.
1	12 "	Christ Diehl (Brewery)	Defiance, O.
1	12 "	Genessee Oil Works	Buffalo, N. Y.
1	12 "	S. Davis, Jr., & Co. (Packers	Cincinnati, O.
1	50 "	Occidental Packing & Provision Co	Lincoln, Neb.
1	15 "	Thos. McFadden, Jr. (Cold Storage	Pittsburgh, Pa.
1	15 "	Grocers' Supply Co. (Cold Storage)	Pittsburgh, Pa.
*1	40 "	Adolph Coors (Golden Brewery)	Golden, Col.
*1	20 "	F. Conrad (Brewery)	Anaheim, Cal.
*1	25 "	The Sachs-Prudens Ale Co.	Dayton, O.

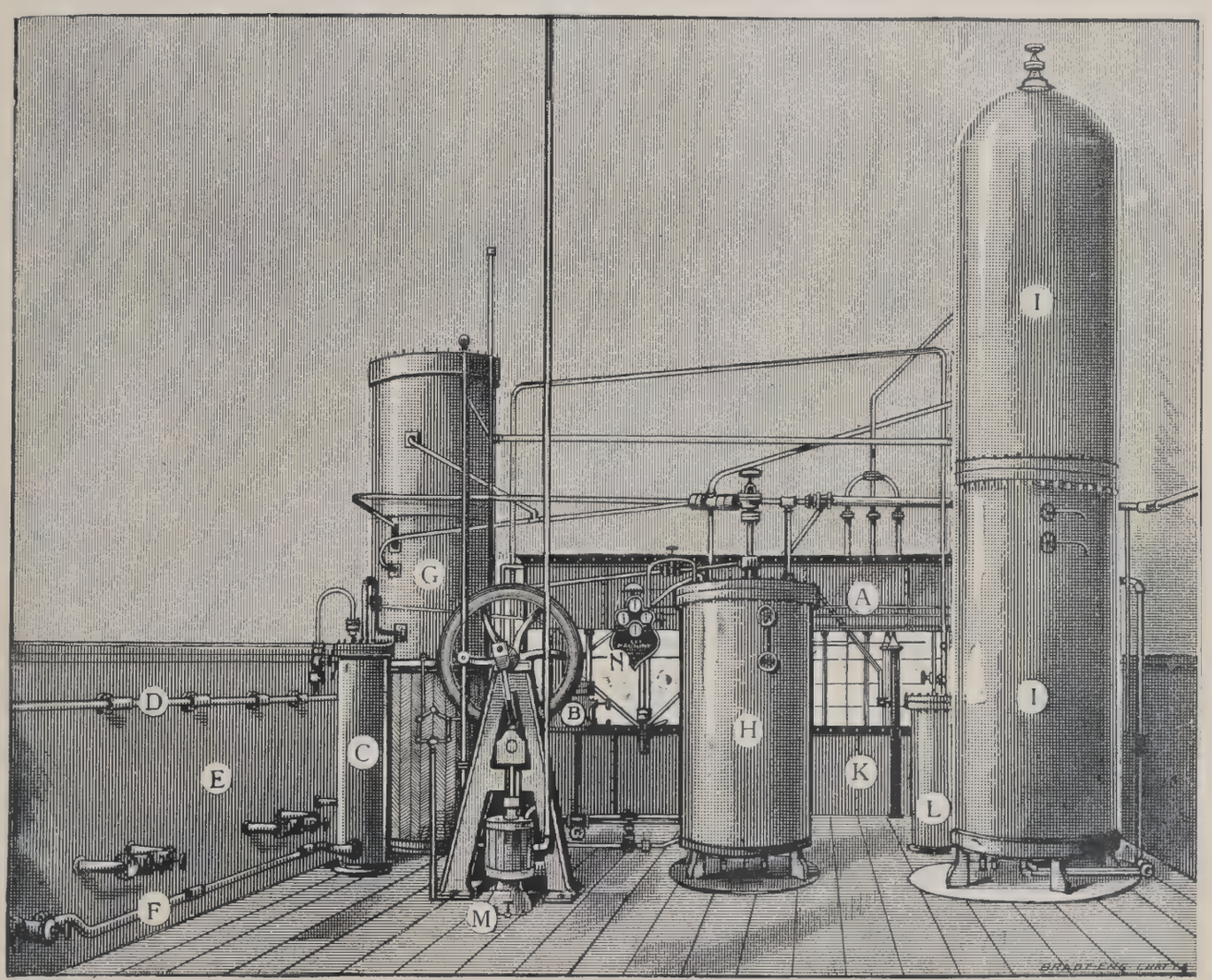
* These machines were erected in 1890.

SOUTHERN ICE MACHINE CO.

SOLE OWNERS AND MANUFACTURERS OF

. . . The Latest Improved Absorption . . .

ICE AND REFRIGERATING MACHINE.



.·. THE SOUTHERN .·.

The SOUTHERN ICE AND REFRIGERATING MACHINE is one of the best and has been acknowledged by the most experienced ice manufacturers to work more economical and produce ice cheaper and of a better quality than any other machine on the market to-day.

ALL MACHINES NOW IN OPERATION ARE GIVING PERFECT SATISFACTION.

FOR ESTIMATES AND FURTHER PARTICULARS ADDRESS THE . . . .

SOUTHERN ICE MACHINE CO.

CHATTANOOGA, TENN.

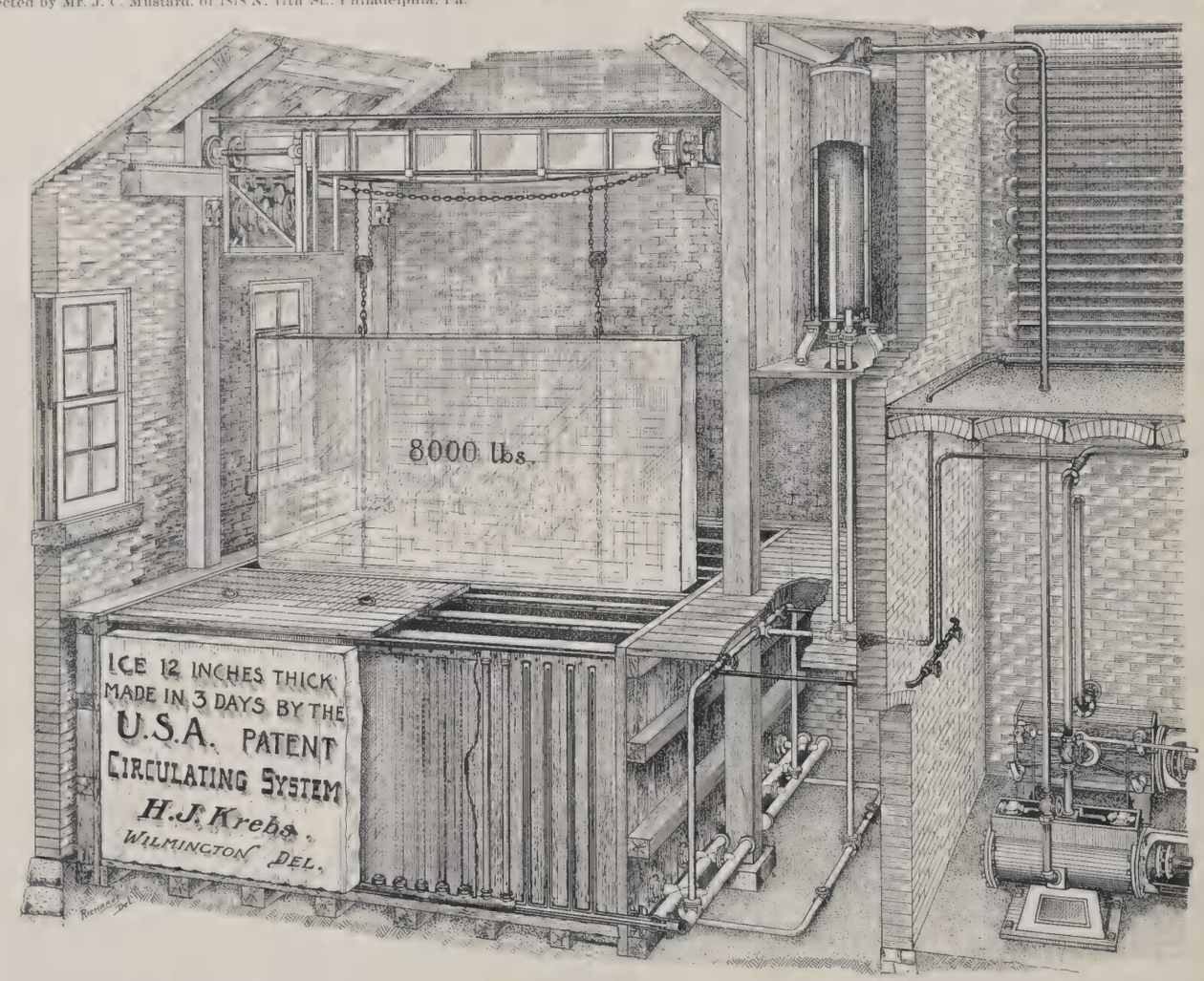
H. J. KREBS' U. S. A. Circulating System of Ammonia

PATENTED SEPTEMBER 9, 1890.

The results achieved by this system, both for brine cooling and ice making, are unexcelled. It ensures dry gas to the pump and abundance of feed to the expansion pipes, therefore economy in piping, economy in ammonia and economy in space. It is simple and easily operated, and saves time, money and worry.

IN ORDERING MACHINES SPECIFY THE U. S. A. CIRCULATING SYSTEM.

During last year it was introduced with great success in the following establishments: Charles W. Street, Packing House, Baltimore, Md.; Washington Abattoir Co., Bennings, D. C.; New Abattoir, Philadelphia Stock Yards, Philadelphia, Pa.; Wilmington Abattoir and Cold Storage Co., Wilmington, Del. These plants were erected by Mr. J. C. Mustard, of 1818 N. 17th St., Philadelphia, Pa.



This system is suitable for all makes of Compression Machines. It secures ample feed to the expansion pipes and a regular flow of dry gas to the compressors, which thereby are enabled to do more and better work.

SOME OF THE ADVANTAGES ARE: Reduced number of valves, reduced pipe surface, reduced first cost, reduced consumption of ammonia, reduced attendance, reduced space, reduced wear and tear, reduced bills, increased refrigerating effect, increased certainty of operation, increased life of machinery, increased satisfaction, increased balance sheet. For full particulars address

H. J. KREBS, M. E., WILMINGTON, DEL.

J. C. MUSTARD,

1818 North 17th Street, Philadelphia, Pa.

BUILDER OF

ICE MAKING AND REFRIGERATING MACHINES

DURING LAST YEAR I HAVE ERECTED THE FOLLOWING PLANTS:

∴ REFRIGERATING . MACHINES ∴

N. Autle, Pork Packer,	Washington, D. C.	Big Elk Dairy,	Oxford, Pa.
C. Spuck, Sausage Maker,	Baltimore, Md.	West Chester Dairy,	West Chester, Pa.
David Eichner, Pork Packer,	Baltimore, Md.	Chas. W. Street, Packing House,	Baltimore, Md.
J. F. C. Hansen, Pork Packer,	Baltimore, Md.	Washington Abattoir Co.,	Bennings, D. C.
Jos. J. Martin, Brandywine Dairies,	Cossart, Pa.	Wilmington Abattoir and Cold Storage Co.,	Wilmington, Del.
R. W. Downing, Wallingford Dairy,	Wallingford, Pa.	New Abattoir, Philadelphia Stock Yards,	Philadelphia, Pa.
H. B. & E. A. Pugh, Dairy,	Oxford, Pa.		

∴ ICE . PLANTS ∴

J. S. Bell & Sons, Ice Factory, Norfolk, Va. Suffolk Ice Co., Suffolk, Va.

The last named plant I am now about starting, having changed it from absorption to compression. A number of above plants are fitted with the U. S. A. Circulating System, which for efficiency, economy, and simplicity cannot be surpassed. My long experience in the ice and refrigerating trade enables me to select the best, and I take especial pride in furnishing high grade machinery at moderate cost.

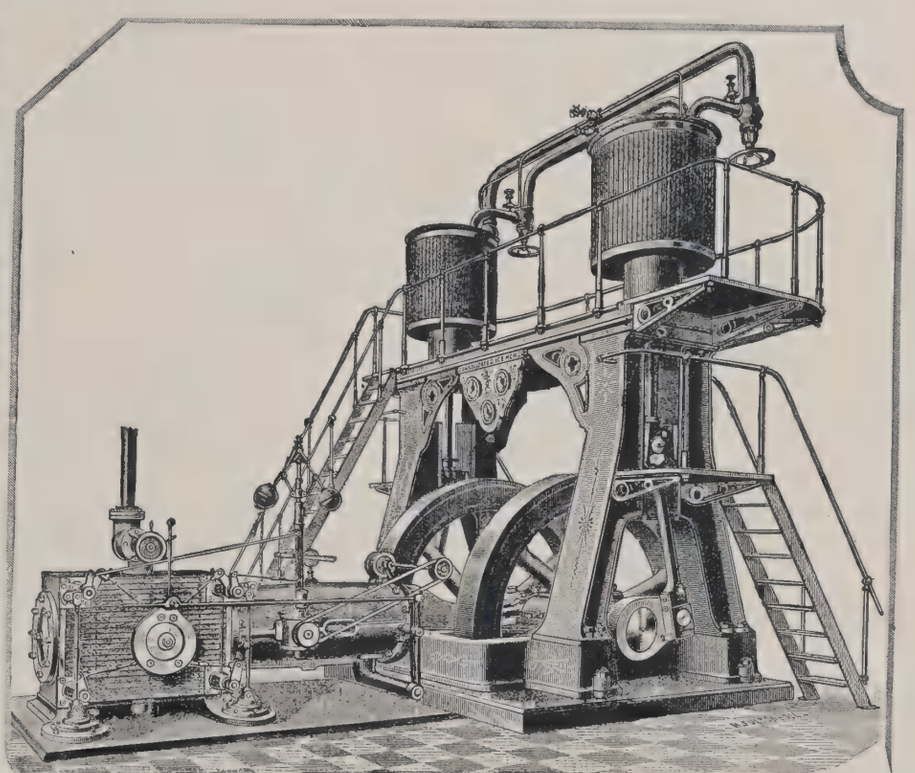
J. C. MUSTARD,

1818 North 17th St., Philadelphia, Pa.

CORRESPONDENCE SOLICITED.



CONSOLIDATED ICE MACHINES



FOR several years past we have been engaged in building Consolidated Ice Machines, and many of the very best running in the United States, at the present time, are of our manufacture. Since the original Company have failed, we have concluded to continue this business, and hereafter will manufacture, to order, any kind or style of a Consolidated Ice Machine desired. We will also contract for complete plants, and will put in either direct or brine circulation, as may be desired. We make a specialty of furnishing duplicate parts, and keep them always in stock, and can furnish on short orders any detail of these machines. We manufacture special steel valves and white metal rings designed especially for ammonia work.

We guarantee protection against any and all claims or pretended claims for patents on these machines.

These machines are known throughout the United States for the excellence of their construction, and their superiority to all others in use. They need no better recommendation than their own work. All the material and workmanship on them is of the finest quality. We have the original drawings and patterns in our possession, and can furnish a better machine for less money than can be built elsewhere. We also manufacture and keep on hand to supply the trade the finest steel fittings and steel valves made in the world, designed especially for ammonia work, and will be pleased to quote prices to purchasers.

NOTE.—It has come to our knowledge that parties owning or claiming to own a bogus patent, issued to one James Boyle in 1876, for an ammonia compressor, have been putting in circulation notices that the pumps used on the Consolidated Refrigerating Machines is an infringement on said patent, and that they will bring suit against any one using them; therefore we hereby guarantee to all persons purchasing one of our machines protection against said fraudulent claims, and request all persons receiving one of such notices to forward the same to us, with a statement setting forth whether they have been influenced not to buy a Consolidated Machine thereby. We also give the parties setting up these claims public notice that we will bring suit against them for damage to our business by them, by misrepresentation and fraud.

JOHN FEATHERSTONE'S SONS,

2-36 Front Street, Corner North Halsted,

CHICAGO.

THE DE LA VERGNE REFRIGERATING MACHINE CO.

MANUFACTURERS OF

REFRIGERATING AND ICE MACHINES AND ANHYDROUS AMMONIA . . . .

Foot of East 138th Street (Port Morris.)

NEW YORK, U. S. A.

Over

360

Machines are now in Successful Operation, Representing a Total Capacity Equal to the Melting of over

18.000

Tons of Ice Per day.



Machines are used for the Cooling of

Breweries, Abattoirs and Packing Houses, Markets and Cold Storage, Hotels and Restaurants, Chemical Works, Confectioneries, and Chocolate Manufactories, Steamship Holds, Wineries, Dairies,

AND FOR THE MANUFACTURE OF ICE

A FULL DESCRIPTION OF OUR SYSTEM AND APPARATUS WILL BE SENT TO PERSONS APPLYING FOR THE SAME.

CORRESPONDENCE FROM PARTIES DESIROUS OF CONTRACTING FOR PLANS IS SOLICITED.

Estimates and Proposals will be promptly furnished free of charge as soon as the requirements are made known to us.

PICTET

Ice and Refrigerating Machine

....MANUFACTURED BY....

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

WE DO NOT USE AMMONIA.

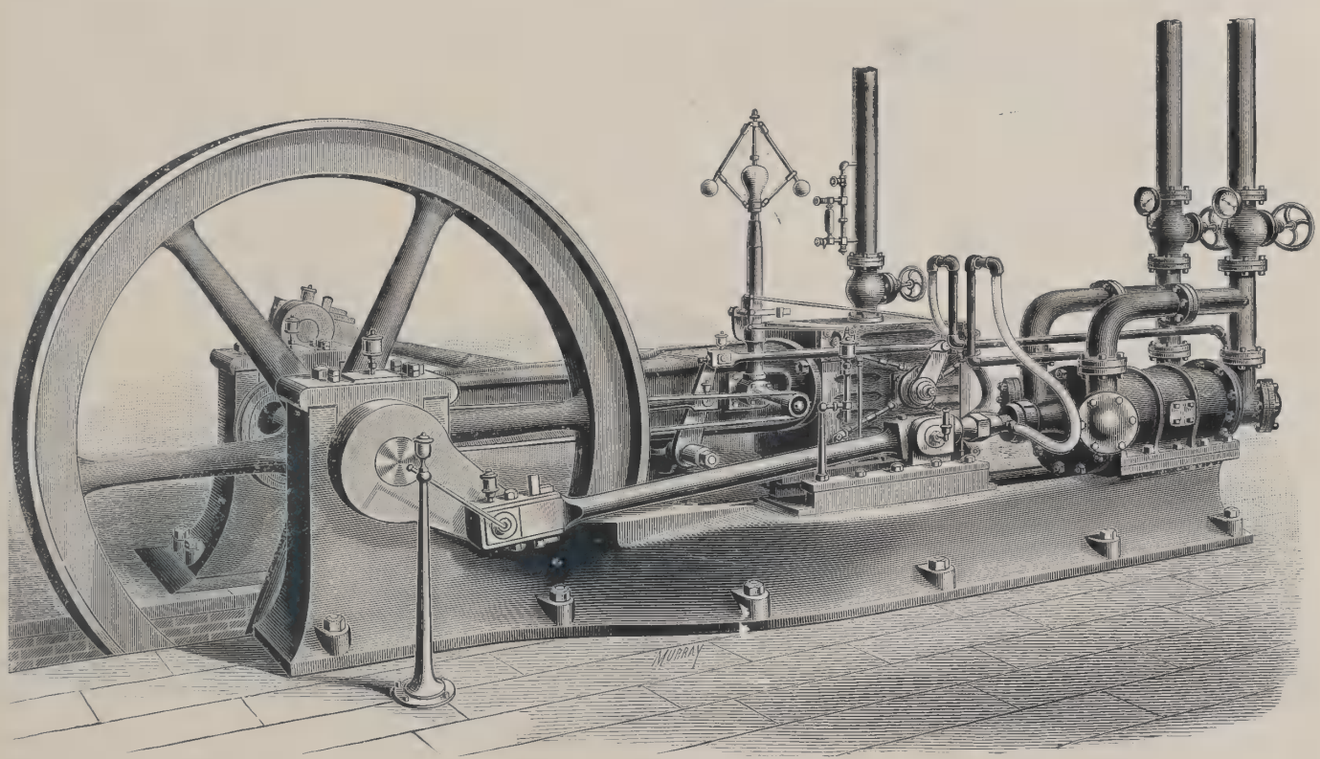
Pictet Machines use **Anhydrous Sulphurous Oxide,** a chemical noted for its low working pressure, is of itself a lubricant, and does not injure any of the metals; its low pressure is a guarantee against explosion.

NEW YORK BOARD OF FIRE UNDERWRITERS.
BUREAU OF SURVEYS
JAMES HARRISON, Supt.
Boreel Building, 115 Broadway, Room 37.

NEW YORK, January 24, 1891.

THE PICTET ARTIFICIAL ICE CO. (Limited), New York:

Dear Sirs: Your favor of the 22d inst. is at hand. In reply, the examination of our expert and his subsequent report were convincing that the article known as Anhydrous Sulphurous Oxide is a safe article for storage or shipment, its tendency being to extinguish rather than to cause fire. Yours truly, JAMES HARRISON, Supt.



Working Pressure from 50 to 75 lbs.

We guarantee GREATER ECONOMY OF FUEL, doing the same amount of work with less coal than any machine in the market.

FOR LIST OF REFERENCES AND FURTHER PARTICULARS, ADDRESS

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

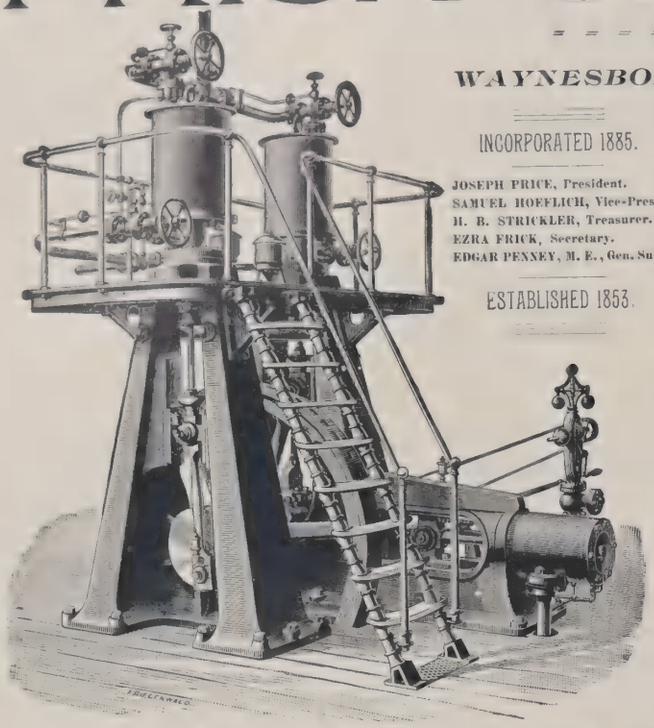
WORKS: NEWBURGH, N. Y.

New York Office, 21 Cortlandt St., Room 6.

FRICK COMPANY

ENGINEERS,

WAYNESBORO, FRANKLIN COUNTY, PA., U. S. A.



5-Ton Machine.

INCORPORATED 1885.

JOSEPH FRICK, President.
SAMUEL HOFFLICH, Vice-Pres.
H. B. STRICKLER, Treasurer.
EZRA FRICK, Secretary.
EDGAR PENNEY, M. E., Gen. Sup.

ESTABLISHED 1853.



MAIN WORKS AND GENERAL OFFICES: WAYNESBORO, PA.

CAPITAL, - - - - - - $1,000,000.

MANUFACTURERS OF THE

ECLIPSE

Ice Making and Refrigerating Machines.

SEND FOR OUR NEW CATALOGUE, 1890.

A Few References:

BREWERIES.

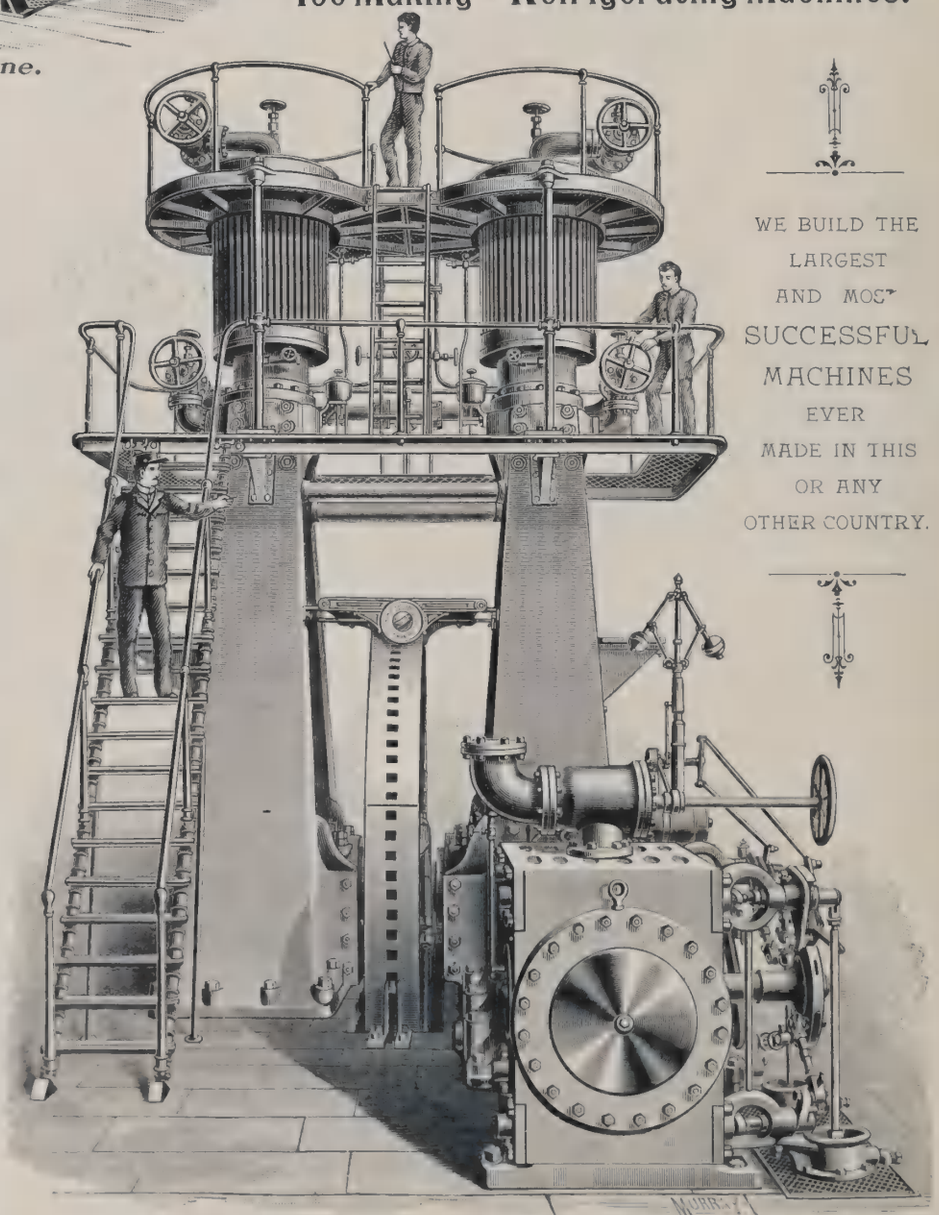
	Refrigerating Tons.
Phoenix Brg. Co., Baltimore, Md.	27
Gipps Brg. Co., Peoria, Ill.	50
Sprattler & Mennell, Paterson, N. J.	32
Herman Lackman, Cincinnati.	65
Henry Fink, Harrisburg, Pa.	32
Seba-tian Helldorfer, Baltimore, Md.	32
Frank Reisch & Bros., Springfie'd, Ill.	50
Jos. Stem & Co., Louisville, Ky.	23
Meyer & Reidlin, Covington, Ky.	32
Parkersburg Brg. Co., Parkersburg, W. Va.	27
Bellevue Brg. Co., Cincinnati, O.	50
Cumberland Brg. Co., Cumberland, Md.	27
D. Lutz & Son, Allegheny, Pa.	50
Herman Lackman, Cincinnati (2d order).	80

PACKING AND COLD STORAGE.

J. C. Shafer & Co., Baltimore	40
G. Cassard & Sons, Baltimore	25
Baltimore City Storage Co., Baltimore	32
Armour Packing Co., Kansas City	100
Shallcross & Son, Cortesville, Pa.	15
Washington Market Co., Washington, D. C.	32
Armour Pckg. Co., Kansas City (2d order)	150
Francis Whittaker & Sons, Wichita, Kas.	150
Emil Winters, Pittsburgh, Pa.	37
Frank Seifrid, Louisville, Ky.	7
Chicago Packing & Provision Co., Chicago	150
Chicago Packing & Provision Co., Chicago (second order)	150
Steelton Store Co., Steelton, Pa.	10
Pittsb'gh Meat Supply Co., Allegheny, Pa.	50
J. Vogle & Son, Cincinnati	50
John C. Hately, Chicago	65
G. H. Hammond & Co., Hammond, Ind.	150
G. H. Hammond & Co., Omaha, Neb.	150
Calumet Canning Co., Hammond, Ind.	32
West Chester Cd. Stor. Co., W. Chester, Pa.	40
Chautauqua Lake Ice Co., Pittsburgh, Pa.	20

ICE FACTORIES.

	Ice. Tons.
E. A. [illegible] & Co., Hopkinsville, Ky.	10
Consumers Ice Co., New Orleans, La.	100
Little Rock Ice Co., Little Rock, Ark.	35
Owensboro Ice & Cd. Stor. Co., O'sb'o, Ky	20
W. S. Larton, Jacksonville, Ill.	15
Pulaski Ice Co., Pulaski, Tenn.	5
Armour Packing Co., Kansas City.	75
Ewing & Bear, Uniontown, Pa.	15
S. W. Hill, Allegheny, Pa.	18
Chautauqua Lake Ice Co., Pittsburgh.	40
Chautauqua Lake Ice Co., Pittsburgh (2d order)	40
West Chester Ice Co., West Chester, Pa.	15
Steelton Store Co., Steelton, Pa.	2
Parkersburg Brg. Co., Parkersburg, W. Va.	3
Cumberland Brg. Co., Cumberland, Md.	8
Hagerstown Ice Co., Hagerstown, Md.	20
Alberto Malo, City of Mexico, Mex.	25
Germantown Ice Co., Germantown, Pa.	20
Bryn Mawr Hotel Co., Bryn Mawr, Pa.	20
Geo. S. Sexton & Co., Wytheville, Va.	5
Cambridge Ice Co., Cambridge, Md.	10

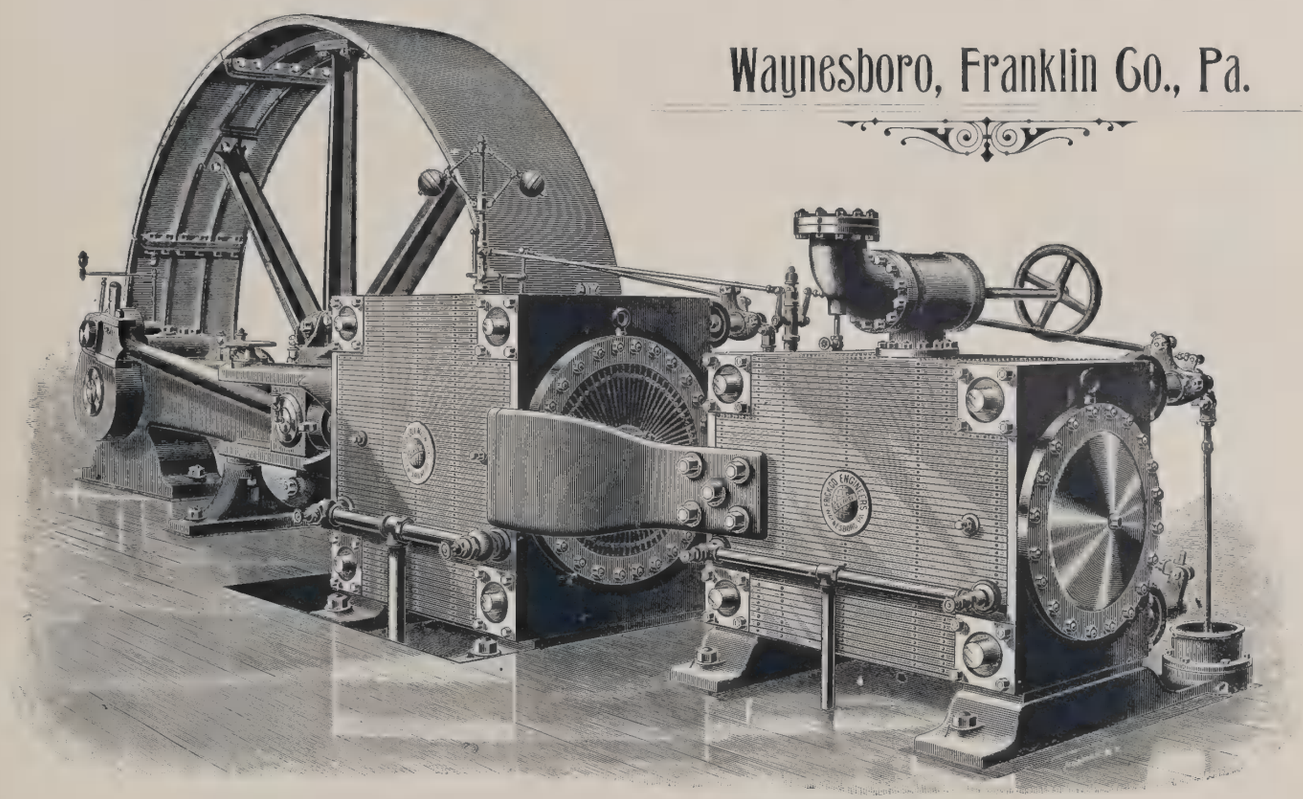


150-Ton Machine. Weight, 193,250 Pounds.

WE BUILD THE LARGEST AND MOST SUCCESSFUL MACHINES EVER MADE IN THIS OR ANY OTHER COUNTRY.

FRICK COMPANY, ENGINEERS,

Waynesboro, Franklin Co., Pa.



A GENUINE CORLISS ENGINE WITH ALL THE LATEST IMPROVEMENTS.

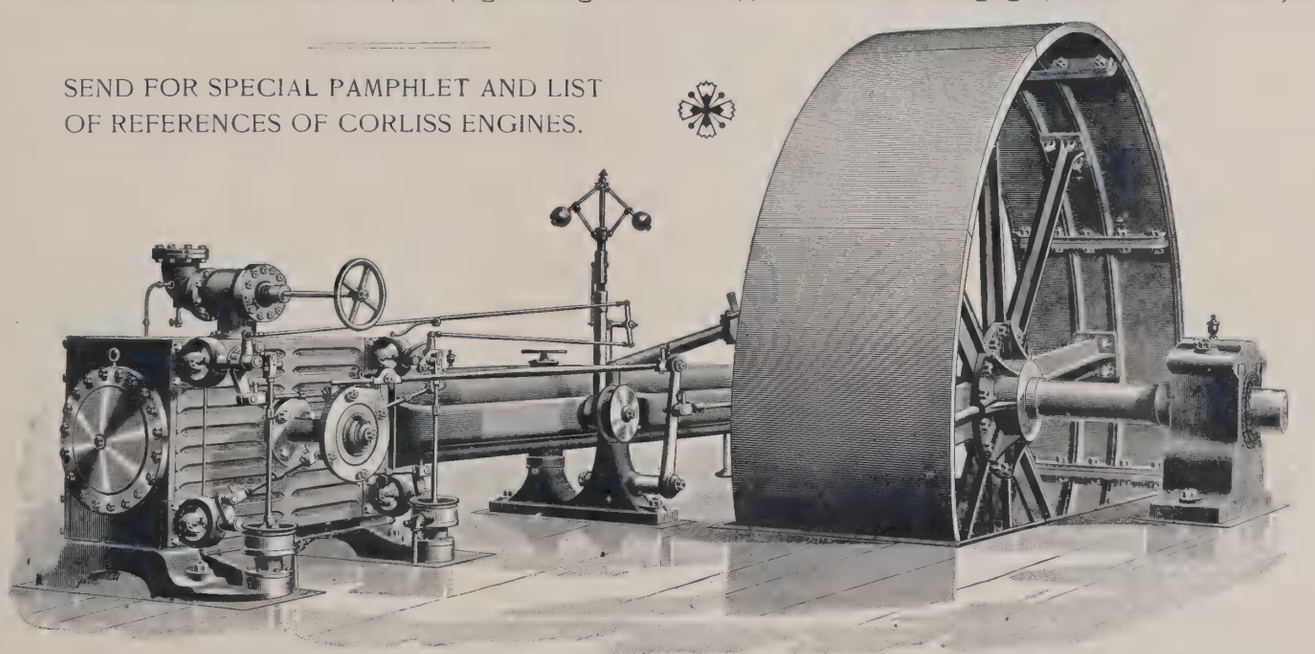
"EGLIPSE" CORLISS TANDEM COMPOUND CONDENSING ENGINE

UP TO 3000 HORSE POWER

We have complete line of patterns and build Corliss Horizontal Stationary Engines, Corliss Vertical Engines, Condensing or Non-Condensing, Single or in Pairs. Corliss Compound Engines, Tandem or Cross Compound. Corliss Engines for any service, 40 to 3000 horse power, in a single engine.

SPECIAL NOTICE.—With our Corliss Engine we contract for fitting up complete the entire Steam Plants, including Steam Boiler, Feed Water Heater, Feed Pumps, Piping, Shafting, and all the appurtenances and belongings peculiar to a first-class job.

SEND FOR SPECIAL PAMPHLET AND LIST OF REFERENCES OF CORLISS ENGINES.



1000 HORSE POWER "EGLIPSE" PLAIN CORLISS ENGINE.

THE WILSON-SNYDER MFG. CO.

MANUFACTURERS OF AUGUST SNYDER'S PATENT

Ice and Refrigerating Machine

SPECIALLY DESIGNED TO MEET THE DEMANDS OF ICE MAKERS AND REFRIGERATION IN ALL ITS APPLICATIONS . . . . . .



INTERIOR VIEW OF WORKS OF THE WILSON-SNYDER MFG. CO.

TWO styles of these machines are built: One, single acting compressor, with duplex condensers and brine tanks; the other, duplex compressor, condensers and brine tanks. The special advantages of this machine over all others are as follows: In either the single or duplex machine, either one of the brine tanks or condensers getting out of order, or anything happening to necessitate repair, the system of valves is so arranged as to allow using but one condenser or one brine tank, and the machine is kept running with the disabled part as though nothing had happened, while the disabled brine tank or condenser is being dismantled and repaired. Write for list of machines in operation, references, prices, etc. . . . . .

ALSO MANUFACTURERS OF IMPROVED . . . .

PUMPING MACHINERY

Including AIR PUMPS, BRINE PUMPS, HOT AND COLD WATER PUMPS, BOILER FEED PUMPS, TANK PUMPS, Etc.

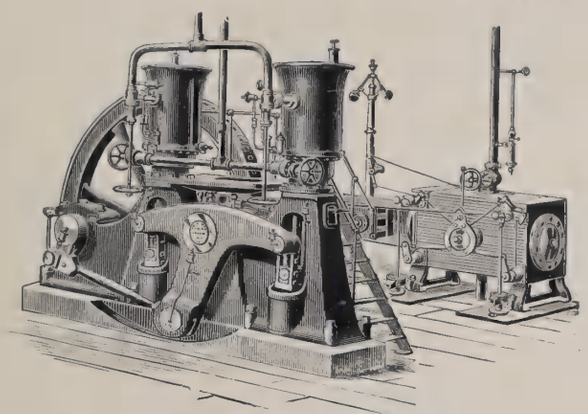
Ammonia Valves, Pipe Coils and Pipe Fittings

OF EVERY DESCRIPTION

PITTSBURGH, PA.

THE HERCULES ICE MAKING AND REFRIGERATING MACHINE

(REFRIGERANT: ANHYDROUS AMMONIA.)



THE HERCULES ICE MACHINE.

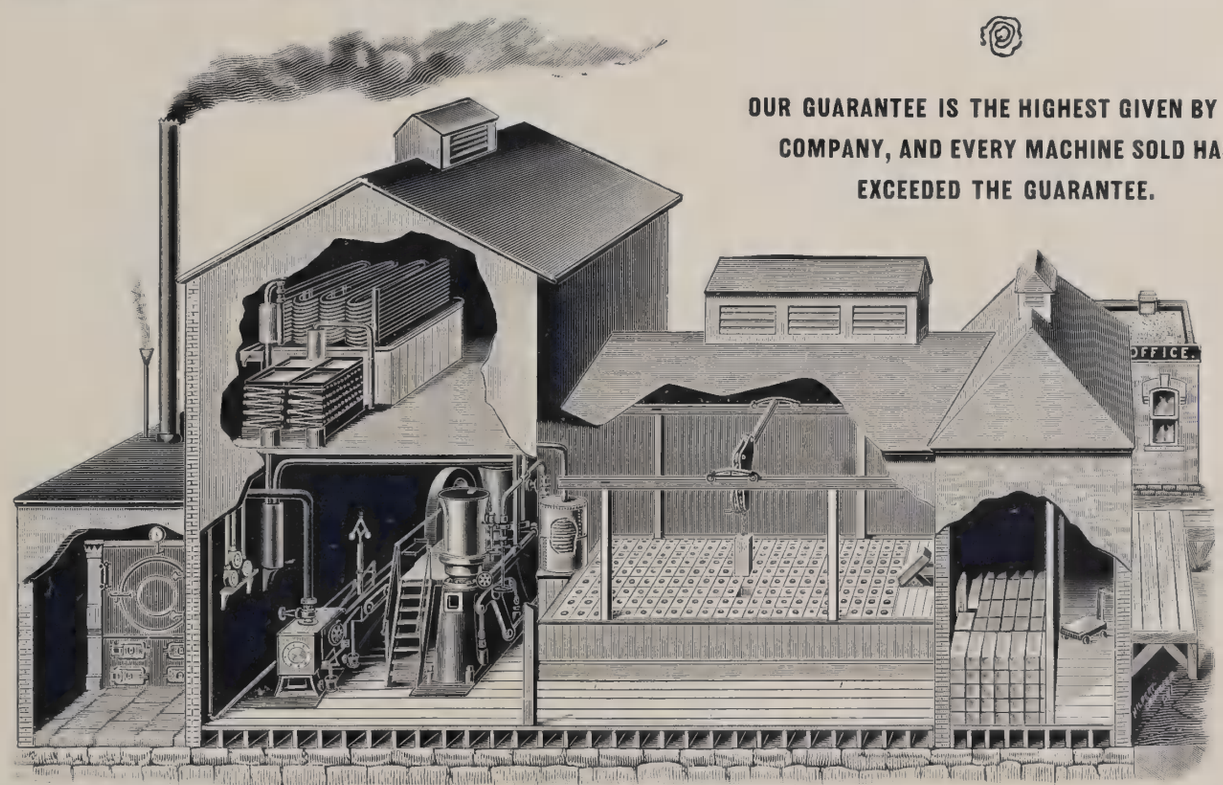
FOR BREWERIES, PACKING HOUSES, COLD STORAGE AND ICE MAKING.



HERCULES WORKS, AURORA, ILL.

The Hercules Ice Machine is the most compact, most economical, most easily handled, well constructed, and thoroughly satisfactory machine in the market.

OUR GUARANTEE IS THE HIGHEST GIVEN BY ANY COMPANY, AND EVERY MACHINE SOLD HAS EXCEEDED THE GUARANTEE.



THE HERCULES MODEL ICE PLANT.

A. NUNNING BREWING CO.

ST. JOSEPH, MO.

HERCULES IRON WORKS, October 13, 1891.
CHICAGO, ILL.

In reply to your inquiry relating to the 40-ton Refrigerator placed by you in our brewery, I am pleased to say the machine has more than met our expectations, and your guarantee fully demonstrating its worth and reliability. It has the past year ran continuously night and day, and has not occasioned any stop for repairs of any kind, and we are greatly pleased to add our name to the long list of testimonials which the Hercules bears. Yours respectfully,

AUG. NUNNING, President.

MEADERS & OSGOOD,

NASHVILLE, TENN.

HERCULES IRON WORKS, July 29, 1891.
CHICAGO, ILL.

Our 25-ton Ice Machine purchased of you, after one month continuous operation has given such complete satisfaction that we do not wish a test of its abilities to perform the work guaranteed. It is now making with ease twenty-five tons daily of the finest ice we have ever seen, besides refrigerating our storage ice house. Congratulating you upon its good work, and wishing you the success you deserve, we are, sirs. Yours respectfully,

MEADERS & OSGOOD.

THE HERCULES BLUE BOOK No. 1, FULL OF HELPFUL AND INTERESTING INFORMATION, IS NOW IN PRESS, AND WILL BE SENT FREE TO INTENDING PURCHASERS.

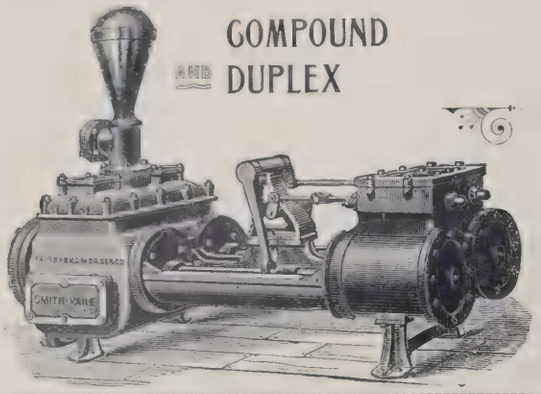
NEW YORK OFFICE, 150 BROADWAY.

THE HERCULES IRON WORKS,

WORKS, AURORA, ILL.

Room 502 Owings Building, Dearborn and Adams Sts., CHICAGO.

THE SMITH & VAILE CO. DAYTON, OHIO.



COMPOUND AND DUPLEX

STEAM PUMPS

FOR EVERY PURPOSE.

WE MAKE A SPECIALTY OF

BRINE PUMPS,
COLD WATER PUMPS,
BOILER FEED PUMPS.

FOR

Ice and Refrigerating Machines.

Get our Special Prices before buying elsewhere.

NEW YORK HOUSE, 112 LIBERTY ST.

THE GORDON STEAM PUMP CO.

. BUILDERS OF .

Steam Pumping Machinery

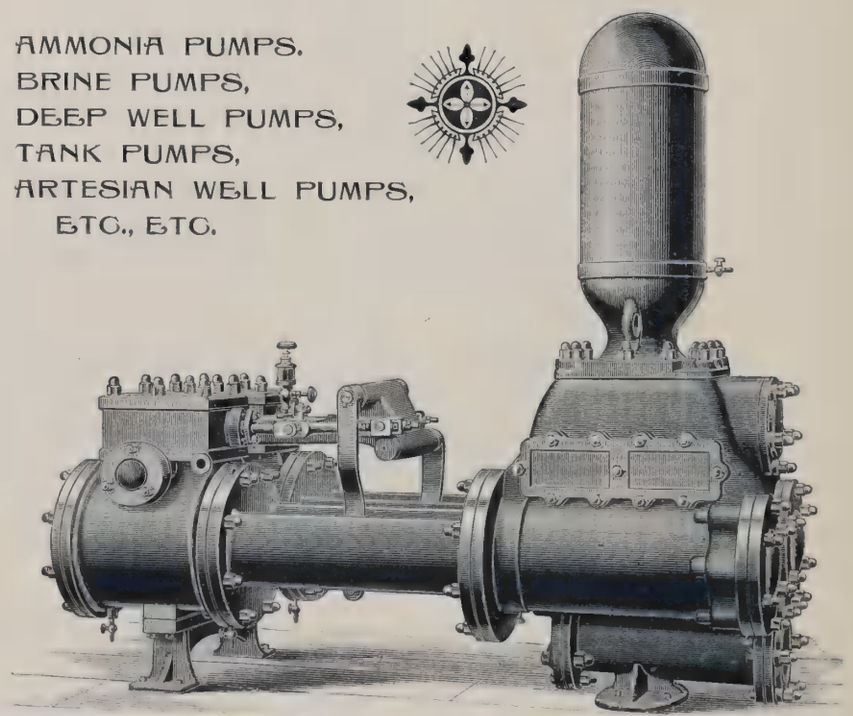
FOR + ANY + SERVICE

Pumps

ESPECIALLY ADAPTED FOR USE IN CONNECTION WITH

Refrigerating Machinery

AMMONIA PUMPS.
BRINE PUMPS,
DEEP WELL PUMPS,
TANK PUMPS,
ARTESIAN WELL PUMPS,
ETC., ETC.



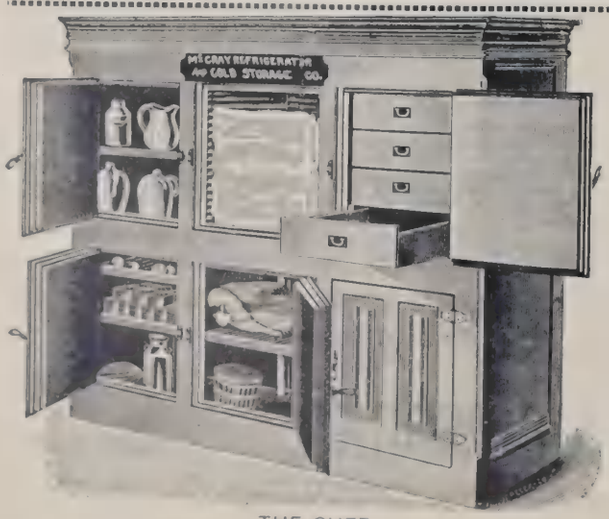
MAIN OFFICE AND WORKS

HAMILTON, OHIO.

BRANCH OFFICES

NEW YORK—136 Liberty St.
PHILADELPHIA—705 Arch St.
PITTSBURGH—410 Lewis Block.
CHICAGO—Phœnix Building.
ST. LOUIS—703 Market St.
CLEVELAND—146 Water St.

Correspondence Solicited.



THE CHEF.

McCray Refrigerator and Cold Storage Co.

KENDALLVILLE, IND.

MANUFACTURERS AND BUILDERS OF ALL KINDS OF

REFRIGERATORS AND COOLING ROOMS

WRITE FOR CATALOGUE AND PRICES.

Special Attention for Ice Cold Storage Buildings.

CHICAGO OFFICE,

Loomis Building, Clark and South Water Streets.

Write for Prices on the . . . . . .

CORRUGATED... ... WATER-TUBE

FEED-WATER HEATER

More Effective and Durable . . . . . .

Than a Coil Heater at the Same Price.

SOLE MANUFACTURERS:

The Wainwright Manufacturing Co. of Mass.

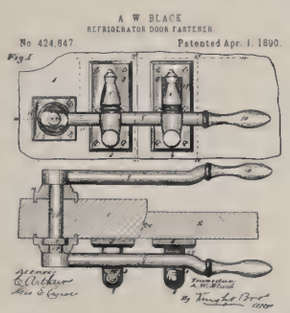
8 Oliver Street. BOSTON.

SEND FOR CATALOGUE I. C.

CHICAGO: 26 West Randolph Street.
NEW YORK: 121 Liberty Street.

BLACK'S

LATEST IMPROVED . . .



Refrigerator Door Fastener

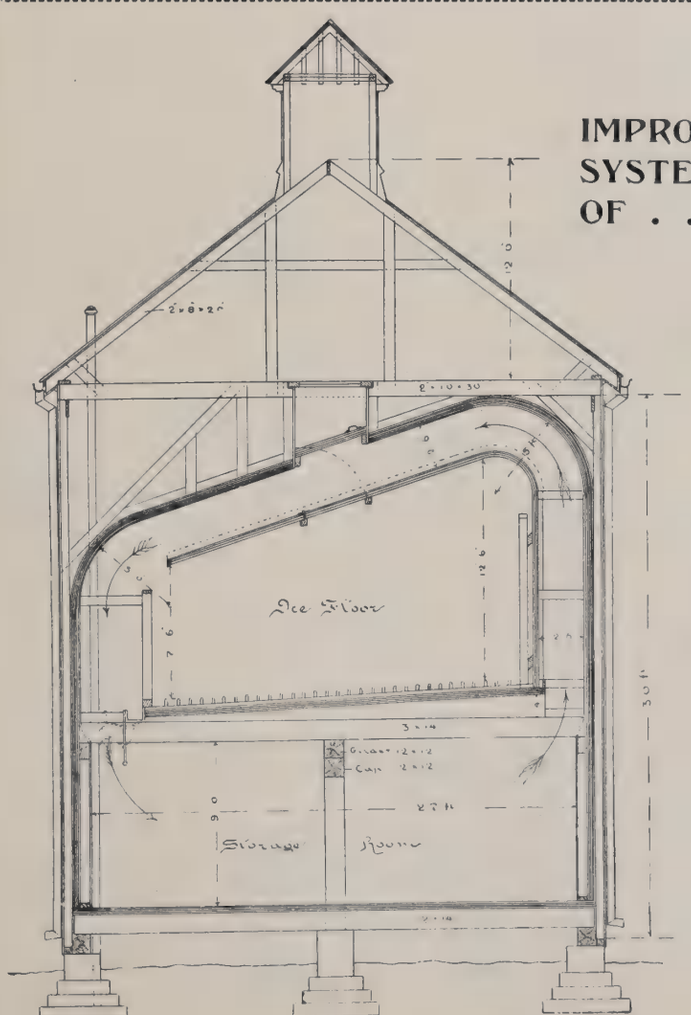
FOR HEAVY DOORS.

ONLY ONE QUALITY MADE, THE VERY BEST BRIGHT BRONZE.

Operates from both sides of door.

NEVER GETS OUT OF ORDER.
SENT BY EXPRESS ON RECEIPT OF $12.

A. W. BLACK, ST. LOUIS, MO.



BLACK'S

IMPROVED SYSTEM OF . . . .

Cold Storage

.....FOR.....

BEEF AND PORK PACKERS,

Creameries, Cheese Factories,
Fruit and Produce Dealers.

ABSOLUTELY DRY AIR,
AN EVEN TEMPERATURE,
PERFECT CIRCULATION,
NO SWEATING.

CAN BE COOLED BY ICE OR MACHINE.

Used in preference to all other systems by the ARMOUR PACKING CO., the leading beef and pork packers of America. A saving of 30 per cent in ice over other systems.

WRITE FOR PARTICULARS.

Plans and specifications furnished parties who have their Builder.

A. W. BLACK, ST. LOUIS, MO.

New York Coal Tar Chemical Co.

10 WARREN ST., NEW YORK.

MANUFACTURERS OF

ABSOLUTELY PURE

ANHYDROUS AMMONIA

AND

AQUA AMMONIA

FOR REFRIGERATING PURPOSES.

AUG. MARITZEN,

Engineer and Architect

WILL FURNISH ON SHORT NOTICE
ALL PLANS, SPECIFICATIONS AND
ESTIMATES FOR COMPLETE . .

COLD STORAGE HOUSES,
ICE FACTORIES,
ICE HOUSES,
BREWERIES, MALT HOUSES,
GRAIN ELEVATORS,
WAREHOUSES,
DISTILLERIES,
ENGINE AND BOILER HOUSES,
ETC., OR ANY OF THEIR SPECIAL PARTS.

And also for Remodeling and Improvements in Old Buildings, Etc.

ROOMS 40, 42, 44, 46, 48, No. 177 LA SALLE STREET,
CORNER MONROE,
Chicago, Ill.

BEST OF REFERENCES FURNISHED AND
SATISFACTION GUARANTEED . . .

The National Ammonia Co.

... ABSOLUTELY DRY AND PURE ...

LIQUID ANHYDROUS AMMONIA AND AQUA AMMONIA (ALL STRENGTHS),

For Refrigerating and Ice Machines.

GENERAL OFFICES:--ST. LOUIS, MO.

Our Ammonias are the Recognized Standards of Quality. Use Our Brands and Secure the Best Results with your Machines.

We are the Largest Manufacturers in the World. Send your Orders to Us and Get Prompt and Satisfactory Service.

Our Ammonia can be had of the following Agents:

NEW YORK—The De La Vergne Refrig. M. Co. ; W. M. Schwenker. ; Mallinckrodt Chemical Works.
PHILADELPHIA—Theo. J. Goldschmid.
BALTIMORE—Wm. Mitchell.
WILMINGTON—Delaware Chemical Co.
BUFFALO—Kast Copper & Sheet Iron Co.
ST. LOUIS—Mallinckrodt Chemical Works. ; Larkin & Scheffer.
CINCINNATI—Herman Goepper & Co.
CLEVELAND—Benton, Myers & Co.
DETROIT—Michigan Ammonia Works.
KANSAS CITY—Henry Menderson.
CHICAGO—A. Magnus' Sons. ; Fuller & Fuller Company.
MILWAUKEE—The Chas. Baumbach Company.
SAN FRANCISCO—Herrmann & Company.
PORTLAND, ORE.—Snell, Heitschu & Woodard.

B. P. CLAPP AMMONIA COMPANY,

MANUFACTURERS OF

ABSOLUTELY PURE - - 26° AQUA AMMONIA

Containing 29 ¼ per cent of Ammonia.

FOR REFRIGERATING PURPOSES AND THE TRADE . . . . . .

GENERAL OFFICES

245 BROADWAY, NEW YORK.

THE CLEVELAND ANHYDROUS AMMONIA WORKS

THOS. FLESHER, JR., Proprietor.

MANUFACTURERS OF ...PURE... Anhydrous Ammonia.

70 E. Prospect St., CLEVELAND, OHIO.

WM. B. SEVERN. A. L. CAVEN.

SEVERN & CAVEN,

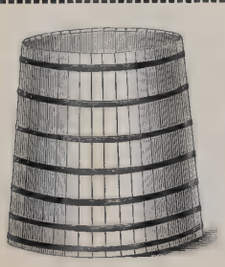
MANUFACTURERS OF

ABSOLUTELY PURE ..... Liquid Anhydrous Ammonia

MANUFACTURED FROM SULPHATE OF AMMONIA ONLY.

WORKS: WHITE HILL, N. J.

OFFICE: 48 N. Delaware Ave., PHILADELPHIA.



GEO. WOOLFORD,

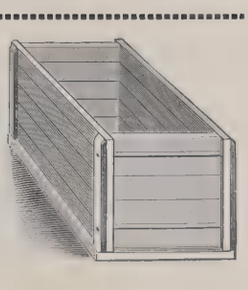
Manufacturer of all kinds of

Cedar Vats, Tanks, HOT & COLD Water Tanks, Railroad Tanks

In sending for estimates, state if measurements are inside or outside, and thickness of wood desired . . . . . .

FOR ICE FACTORIES, COLD STORAGE HOUSES RAILROADS, PACKERS, CHEMICAL WORKS, ETC.

2240, 2242 and 2244 North 9th Street, PHILADELPHIA.



THE LAIDLAW & DUNN CO.

PURCHASERS OF { McGOWAN PUMP CO. / ECLIPSE PUMP MFG. CO.

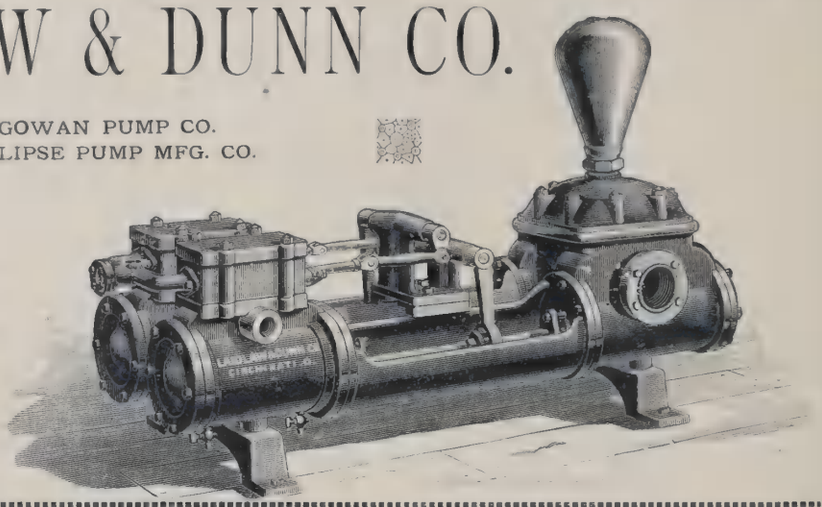
MANUFACTURERS OF

BRINE
WATER
BREWERY

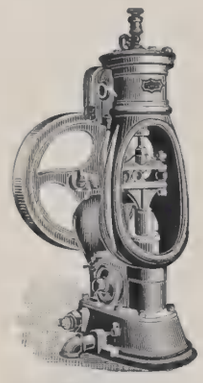
PUMPS

AND PUMPS FOR ALL PURPOSES.

CINCINNATI, OHIO.



AMMONIAL LIQUID . . . . PUMPS



FOR USE IN.....

ICE MAKING AND REFRIGERATING PLANTS

These Pumps are made very heavy and guaranteed to work smoothly against 300 pounds pressure to the square inch . . . . . .

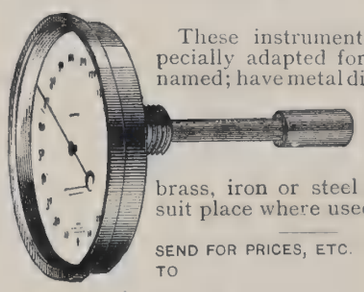
VALLEY PUMP CO.

EASTHAMPTON, MASS.

Standard Thermometers.

FOR USE IN

Ice Machines,
Refrigerators,
Brine Tanks,
Ammonia
Circulating Pipes,
Etc., Etc.



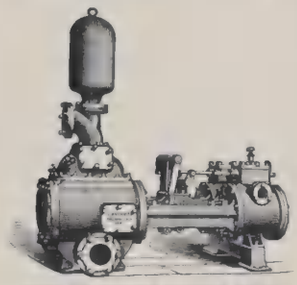
These instruments are especially adapted for purposes named; have metal dials, either brass, iron or steel casing to suit place where used.

SEND FOR PRICES, ETC. TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Cortlandt St. Boston Office, 70 Pearl St.



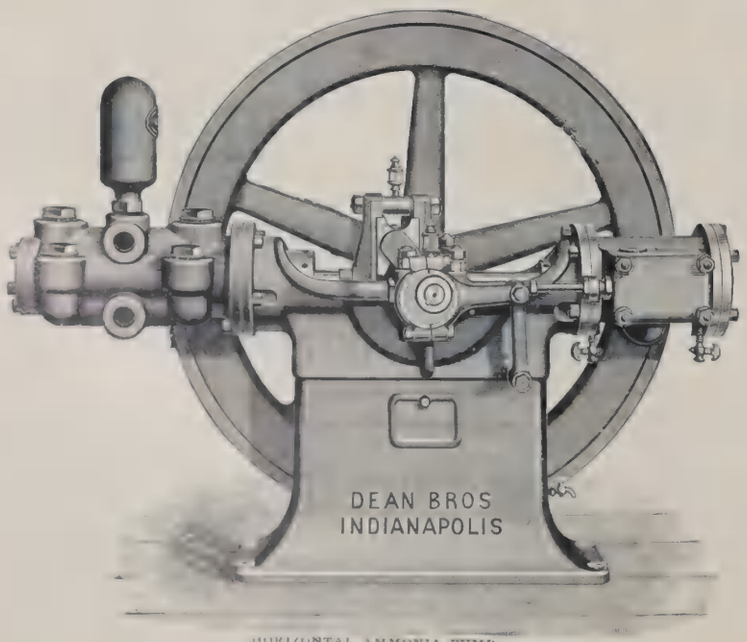
DUPLEX WATER SUPPLY PUMP.

DEAN BROS.

· Steam Pump Works ·

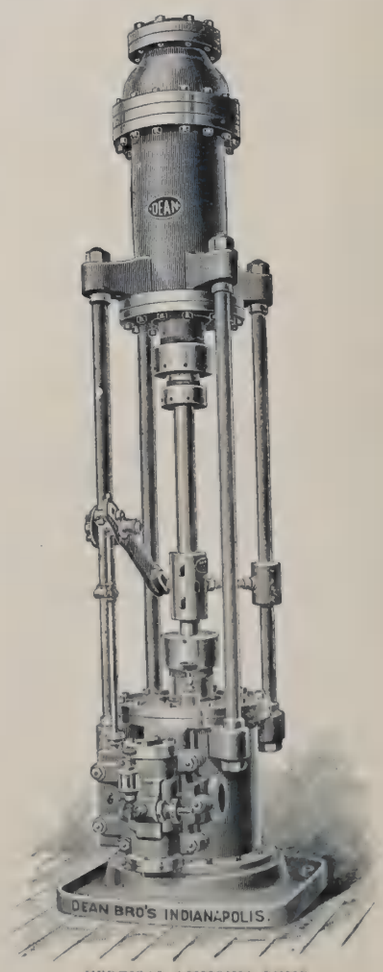
INDIANAPOLIS, IND.

BOILER FEEDERS, BRINE PUMPS,
DEEP WELL PUMPS, SINGLE AND DUPLEX PUMPS.



HORIZONTAL AMMONIA PUMP.

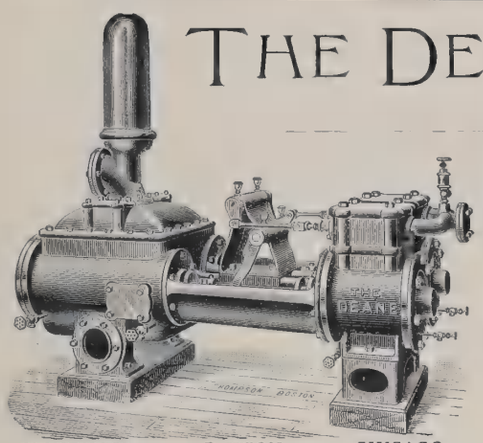
SEND FOR CATALOGUE



VERTICAL AMMONIA PUMP

THE DEANE STEAM PUMP CO.

HOLYOKE, MASS.



STEAM PUMPS

FOR EVERY SERVICE.

AMMONIA PUMPS,
BRINE PUMPS,
TANK PUMPS, ETC.

For Ice Manufacturing Machinery

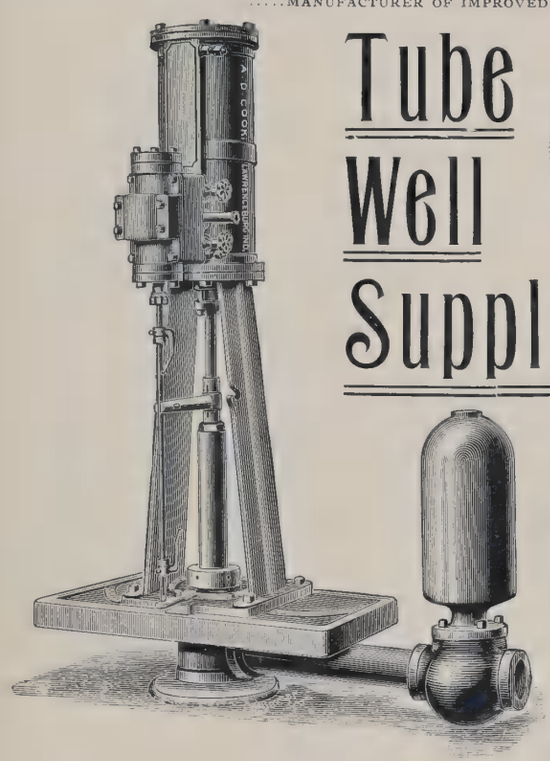
For full information and Illustrated Catalogue, write . . . . . .

NEW YORK BOSTON CHICAGO.
PHILADELPHIA. ST. LOUIS. DENVER.

DEANE STEAM PUMP CO., Holyoke, Mass.

A. D. COOK

.....MANUFACTURER OF IMPROVED.....



Tube Well Supplies

Cook's
Patent
Tube
Well
Strainers

.....AND.....

STEAM PUMPS ...A... SPECIALTY

LAWRENCEBURG, IND.

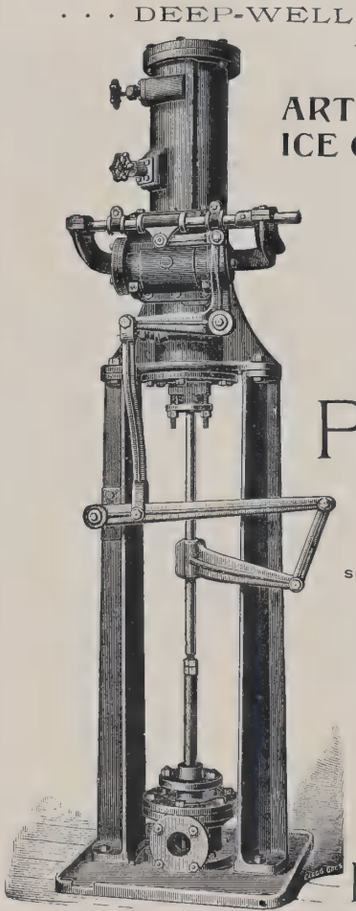
EPPING Pump

. . . DEEP-WELL

....FOR....

ARTIFICIAL ICE COMPANIES

BREWERIES
COLD STORAGE
WAREHOUSES



PUMPS

For all Purposes.

SEND FOR CATALOGUE TO

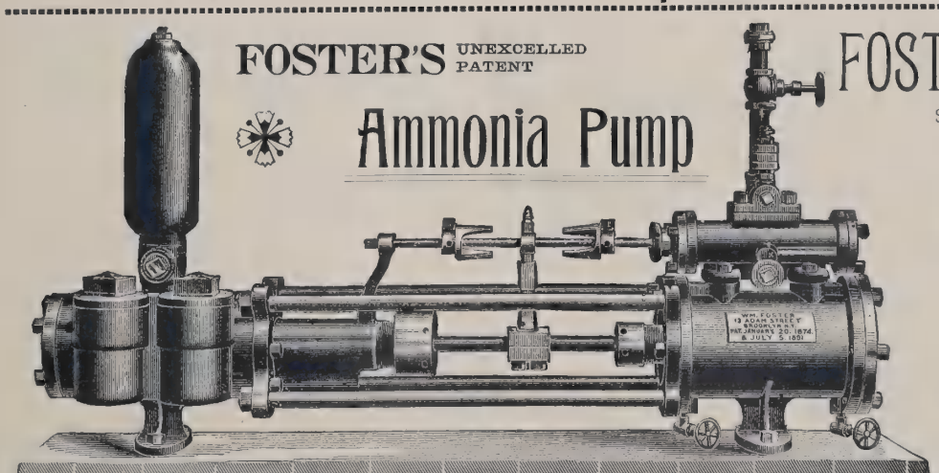
EPPING, CARPENTER & CO. LIMITED,

2410-2420 Penn Ave.,

PITTSBURGH, PA.

FOSTER'S UNEXCELLED PATENT

Ammonia Pump



ing-box is carried back into the suction again. It has extra hard steel Piston Rod, which is made in two sections, so as to be easily replaced when ammonia part of piston rod is worn out, and without necessitating the removal of the steam portion of rod.

FOSTER PUMP WORKS

Successors to WILLIAM FOSTER

MANUFACTURERS OF

PATENT IMPROVED

STEAM PUMPS

FOSTER'S EXCELSIOR ROTARY PUMPS,

Beer and Mash, Boiler Feed, Tank, Air, Deep Well and Artesian Well Pumps.

36 AND 38 BRIDGE ST. BROOKLYN, N.Y.

The advantages of this Pump are, its extra long double stuffing-box, which is so arranged that any leakage from first stuff-

HERF & FRERICHS CHEMICAL CO.

ST. LOUIS, MO.

MANUFACTURERS OF

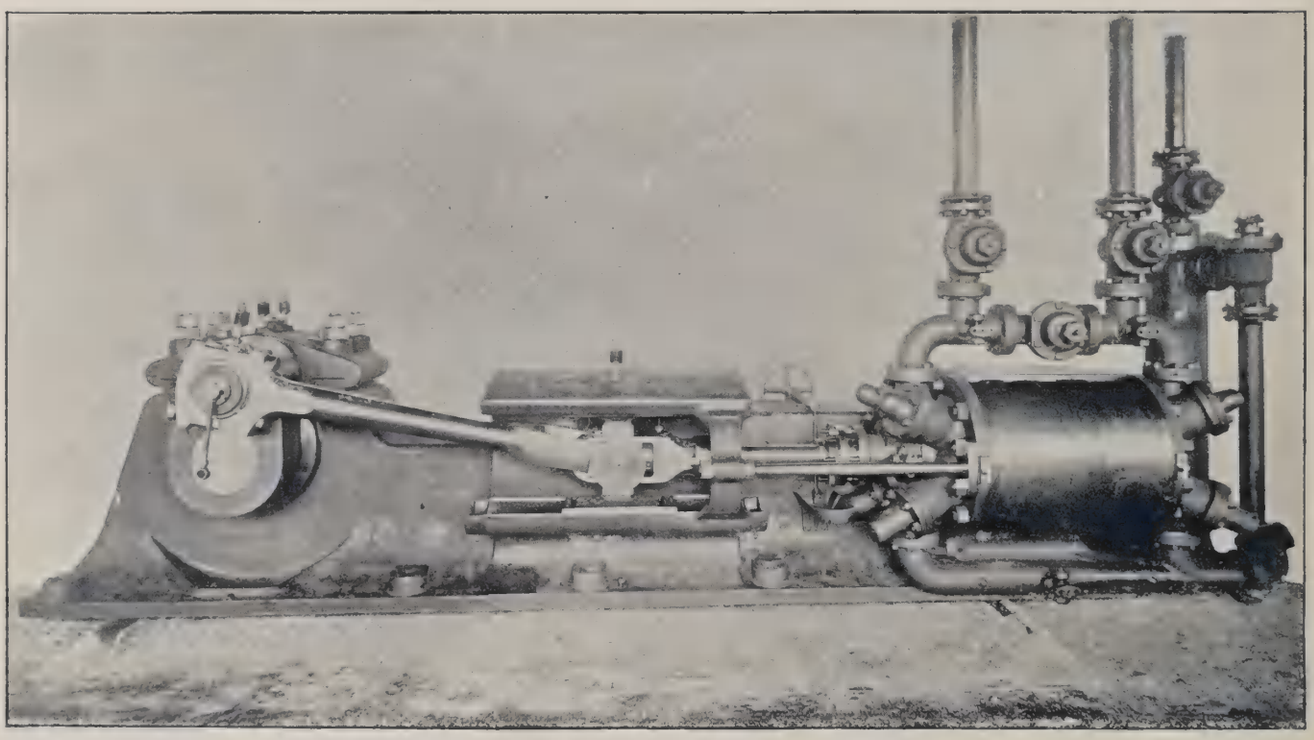
Liquid Anhydrous Ammonia

ABSOLUTELY DRY, PURE AND UNIFORM ALL THE YEAR ROUND . . . . .

26° Ammonia

SPECIALLY PURIFIED FOR ABSORPTION . MACHINES . . . .

All our Ammonia is made from Sulphate Ammonia only. Large capacity, best qualities and quick shipments.



No. 8 LINDE COMPRESSOR

100 TONS CAPACITY.

MANUFACTURED BY

THE FRED. W. WOLF CO.

560 North Halsted Street, CHICAGO, ILL., U. S. A.

FOR ICE FACTORIES, COLD STORAGE HOUSES, BREWERIES AND PACKING HOUSES . . . . .

CORRESPONDENCE SOLICITED. . .

OVER 1300 MACHINES IN ACTUAL OPERATION.

ICE AND REFRIGERATION

ILLUSTRATED

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

VOL. I. NO. 6. CHICAGO : NEW YORK : DECEMBER : 1891. $2.00 PER ANNUM.

[*Written for* ICE AND REFRIGERATION.]

CIRCULATION.

ITS RELATION TO TEMPERATURE, REFRIGERATING COST AND MOISTURE—THE BENEFICIAL EFFECT OF THE CIRCULATION OF AIR IN REFRIGERATION.

BY JOHN E. STARR, M. E.

In the articles in the July and September numbers of ICE AND REFRIGERATION, the writer has endeavored to point out some of the principles governing the process of refrigeration, especially in regard to the value of insulation. The important question of circulation was only referred to in a general way. It is the purpose of this article to try to point out briefly the economic necessity for a good circulation of air in a refrigerator, and the improved character of the refrigeration which follows the employment of means to induce continual and properly directed air currents.

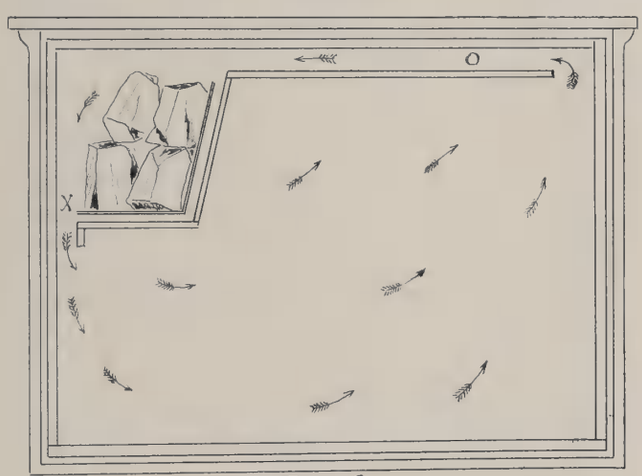


Fig. A

The chief advantages of good circulation may be summed up under these heads:

First: Economy in the use of ice or other refrigerating material, by reason of the box being of nearly the same temperature throughout, instead of being much colder in one place than in another.

Second: The constant collection and elimination of moisture, with its resulting beneficial effect on the material to be refrigerated.

Third: The collection of bad gases and objectionable odors, and their elimination by absorption in the ice water or by the frozen surfaces of piping or metal, where refrigerating agents of low temperatures are used.

Fourth: The increased useful life of the refrigerator.

Without going into a technical discussion of the problem of air circulation, we may, by the use of simple diagrams, give some idea of the great effect that a slight difference of temperature has on the movement of air if the course of its flow is properly controlled, and the lack of good effect when the flow is improperly guided.

Let diagram *A* represent one type of refrigerator, with a common and good form of circulating bulk heads; and diagram *B* another type, without any special provision for *directing* the current. In *A*, when ice is the refrigerant, the layer of air next to the ice surface is cooled, causing it to drop down through opening *X*, and, therefore, to draw in the slightly warmer air through conduit *O*, inducing a certain and definite movement of nearly all the air in the box, and passing it again and again through the bunker and over the ice. A very slight difference in temperature is sufficient to cause a rapid flow. The layer of air immediately next the ice may become quite cold, but the air next to the outside walls of the bunker may be only slightly cooler than the average temperature of the box, if the ice and the air conduits are properly arranged. It is plain, in the case of refrigerator *B*, a common and bad form of ice box, that while a great difference of temperature might exist between the bunker and the body of the box, the effect of circulation is very limited, a large portion of the air remaining stagnant and being cooled only by conduction; and another portion simply eddying round without passing through the ice bunker. The entire ice bunker might therefore be very cold, almost at the temperature

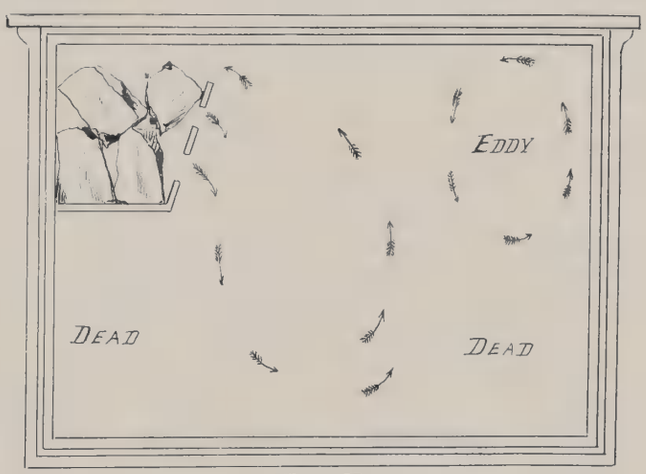


Fig. B.

of the ice, while the main part of the box might be 10° or 20° higher.

An ice bunker oftentimes occupies one-third of the entire box, and its walls expose twenty-five or thirty-five per cent of the entire box service to the outside atmosphere. As stated in the articles on insulation above referred to, the rate of the flow of heat through the insulation is in proportion to the *difference of temperature* existing on each side of the insulated wall. It is plain, therefore, that if we have two boxes exposing an equal amount of wall surface to the outside atmosphere, the

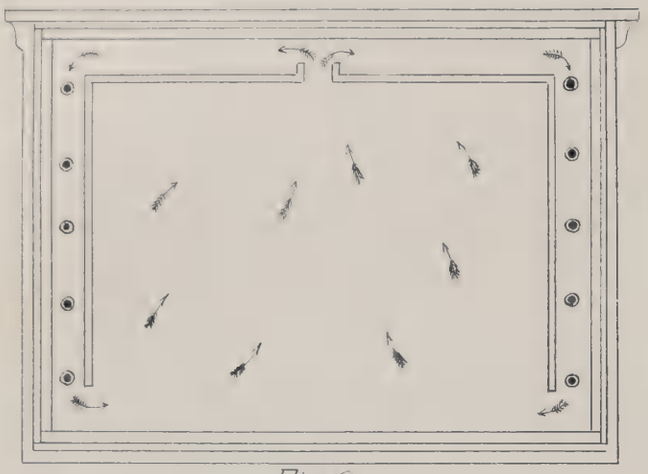


Fig. C

one maintaining the required temperature (say 45°) against its entire surface, and the other maintaining the required temperature against two-thirds of its surface, but holding on the other one-third (the bunker surface) an unnecessary and unavailable lower temperature (say 35°), on account of poor circulation, the latter box would use more ice than the former, but only give the same useful effect.

To reduce this to figures, assume two poorly but equally insulated boxes (such as are noted in one of the articles before mentioned, in the September number of



Fig. D

this journal), and further assume that the boxes each exposed, all told, 1,000 square feet of surface to the outside atmosphere, and that, of 1,000 square feet, 300 square feet was the surface exposed by the ice bunker. If one of these boxes had good circulation, so that the required temperature (say 45°) was even throughout, it would use, per diagram, according to the article mentioned, 1,320 pounds of ice per day. If the other box had such poor circulation as to maintain 45° against 700 square feet of its surface and 35° against 300 square feet, it would use, per diagram, $700 \times 1.32 + 300 \times 2.26 = 1{,}602$ lbs., or $\frac{1602 - 1320}{1320} = 21\%$ more ice on the net *available* temperature assumed of 45°.

While it is admitted that both of these boxes are poorly insulated, it is assumed that they are *equally* insulated; so that for two boxes of better but equal insulation, the proportion would hold the same on the same assumption of temperature.

These considerations show the great importance of



Fig. E

good circulation when the cost of refrigeration is to be considered. The same principles apply as well to mechanical methods of refrigeration; as for example, the arrangements shown in figures *C* and *D* are better than those shown in figures *E* and *F*.

The effects of good circulation on conditions of moisture are marked. The reason why such good effects are produced is easily found in the simple laws of hygrometry. The result of the operation of the circulating air currents is two-fold: to take up moisture that is brought into the refrigerator by the warmer outside air, and to



Fig. F

keep the air in the refrigerator in a relatively dry condition.

It is well known that the capability of air to hold moisture in suspension increases with the temperature of the air. To illustrate: 100 cubic feet of air at 80° can hold in suspension .156 lbs. of aqueous vapor, while 100 cubic feet at 40° can only hold .041 lbs. in suspension.

Now, if a refrigerator is running, say at 40°, of course the inside walls and the material inside of the box will

be at the same temperature. When the box is opened, a current of cold air flows out at the bottom of the door, and an equal amount of warm air, containing per cubic foot a larger amount of moisture than air at 40°, would be sucked in at the top of the door. This warm air, as it becomes cooled down by contact with surfaces inside of the box, loses its ability to hold its aqueous vapor. The amount which it cannot hold becomes condensed and settles on the sides of the box and on the cooled goods, causing the phenomenon generally termed "sweating." If 100 cubic feet of saturated air at 80° were drawn into a box whose temperature was 40°, the quantity of moisture so deposited would amount to .156 — .041 = .115 lbs. This deposit of moisture is cumulative from day to day, until a large amount of water enters the box—enough to make it a very wet and moldy refrigerator unless the moisture is eliminated. The amount so deposited inside the box will, of course, vary with the relative humidity of the outside air; but even supposing the relative humidity of the outside atmosphere is, on an average, say, 70 per cent of the amout of moisture that would saturate it (a condition called fairly dry), the amount entering the box would still be large—in the above case .7 × .156 — .041 = .061 lbs. per 100 cubic feet.

Now, in the supposed box, if the air were simply saturated at 40°, this moisture would still remain to appear as sweat, or dampness, on the walls and on the goods to be refrigerated; but in a box where the circulation is good, it is evident that the air will be constantly passing over the ice or piping, the surfaces of which are colder than the box temperature. If the refrigerating agent is ice, it would be 8° colder; if ammonia or brine, it might be from 20° to 60° colder. Each particle of air, therefore, if the circulation is good, is for a short space of time, during its contact with the refrigerating surface, lowered several degrees below its temperature in the body of the box. During the time it is so lowered, its capability of holding aqueous vapor is reduced, and a portion of such vapor is thrown out or condensed on the refrigerating surfaces, and the air returns to the body of the box in a condition to pick up and carry back to the ice or the piping more moisture. The more rapid the circulation, the more rapidly will the moisture be taken out of the body of the box, and the dryer will the box become, until it reaches its utmost limit of low relative humidity.

In the case of an ice box, this condition is limited by the temperature of ice—32° F. That is to say, a box running at 40° might be reduced to such a point of dryness as to contain only the amount of moisture that would saturate air at 32°, which is .031 pounds per 100 cubic feet; while air at 40° could contain .041 pounds per 100 cubic feet, hence its relative humidity would be $\frac{.031}{.041}$ = 75 per cent, which is fairly dry. It is evident that a box refrigerated with colder surfaces, such as are given by mechanical refrigeration, might become very much dryer than this, even as low as 50 or 60 per cent, a condition often found in practice where proper means for circulation are provided. In this lies one of the greatest advantages of mechanical refrigeration, for it not only produces a dryer atmosphere, but by reason of cooling to a greater degree the air while in contact with the refrigerating surfaces, it produces a more rapid movement.

It is well known that the foul gases and "smells" of various kinds that arise from goods stored in a refrigerator are readily taken up by the moisture in the air. A damp box will smell "louder" than a dry one. Where the circulation of air is good, and where, therefore, moisture is constantly being eliminated from the box, it is evident that the gases will be eliminated also, being carried by the aqueous vapor in the air to the bunker, where such vapor is condensed into water, absorbing the gases and running with them in solution out of the box in the ice water. So, also, are these gases frozen in solution with the moisture on piping where mechanical refrigeration is used—a fact that can be readily established by simply melting some of the snow scraped off the piping. The water will be found to smell and taste strongly of the goods stored in the box, and, perhaps, of other things not so pleasant.

The presence of moisture also materially assists decomposition, so that the amount of foul gases in a box having poor circulation is cumulative, until it reaches a point where the most careless box owner is compelled to "clear out and clean up." Even if this periodical "house cleaning" is resorted to, the wood and insulation becomes moist and rotten, until the box either falls to pieces or has to be abandoned. There are few boxes but can be changed from very poor to fairly good ones, as far as circulation is concerned, by the use of a saw and hammer, a few boards, some nails, and a little common sense.

EX-GOV. HOBART B. BIGELOW, DECEASED.

Ex-Gov. Hobart B. Bigelow, treasurer of the Craf Refrigerating Machine Co., of New Haven, Conn., died October 12, after an illness of about two weeks, suffering from an attack of Bright's disease.

Gov. Bigelow was born in North Haven, Conn., May 16, 1834, and lived there until he was ten years of age, when his father, Levi P. Bigelow, removed to Great Barrington, Mass. Through his mother's family he was connected with the Pierrepont family, of which Edwards Pierrepont, the eminent jurist, was a member.

He was given a common school education, but was apprenticed to the machinist's trade at the age of seventeen, in which business he continued until he was at the head of the Bigelow boiler works. His political career began with service in the board of councilmen of New Haven.

In the spring of 1875 he was elected a member of the legislature from New Haven, and in December, 1878, was chosen mayor of the city. Being a republican, this was a great triumph, as the city is democratic. His election as governor followed in 1880, and as chief executive of the state he won hearty approval from the entire state. He was a life-long republican, an earnest and consistent Christian, and a remarkably successful business man. He leaves a widow and two sons.

A CURIOUS cave has been discovered in Kansas, in which the cold is so intense that it freezes water in a few minutes. Nature seems to have prepared for the reception of the remains of the Universal Refrigerating Co.

MANY of the ice ponds in Westchester county, N. Y., were, November 19, covered with a coating of ice. The thermometer in the morning stood at 22°.

Written for ICE AND REFRIGERATION.]

THE TRANSPORTATION OF FRUIT.

COMPARATIVE ADVANTAGES OF REFRIGERATOR AND VENTILATED CARS IN THE TRANSPORTATION OF FRUIT FROM THE PACIFIC COAST EASTWARD.

BY A CORRESPONDENT, "F."



A RECENT article in the *California Fruit Grower* says: "Refrigerator cars have come to stay." It is a fact. The *California Fruit Grower* also makes the comparison of shipments of fruit in ventilated fruit cars and refrigerator cars, and, in making the comparison, says: "The refrigerator car carries an extra burden of 4,000 pounds of fruit; that is, the shipper must furnish that larger quantity of fruit over the old style of ventilated fruit cars." The writer omits to state some of the other advantages of refrigeration in the shipment of fruit. Well posted fruit men will tell you that the shrinkage on orange shipments in ventilated cars is often 30 per cent lost. Three hundred boxes to the car at 30 per cent is ninety boxes gone. We have seen shipments of oranges reach the Chicago market in June, the shrinkage of which would have been much greater than this had they been made in ventilated cars. As it was, the shipments were in good order, and the shrinkage not over 3 per cent to the car load. This shows that the advantages of making shipments in refrigerator cars are becoming appreciated by the shippers of fruit, both from Florida and from California, and largely increased shipments will follow the introduction of proper systems of refrigeration.

It is not necessary to carry ten or twelve tons of ice in order to refrigerate a car of fruit *en route*. Plans are being formed for the proper treating and handling of this fruit before shipment, which will reduce the quantity of ice required in some of the cars now in use.

In the same issue of the paper referred to, it is said, page 289: "Dry air is a preservative of the fruit, and the shipper refers to shipments being made on very dry and hot days."

This very fact is in favor of refrigeration and the adoption of a good system of preparation of the fruit before shipment, as the air, at a temperature of 40° and 50°, does not contain the moisture which is the principal element of decay in shipments of this fruit for long distances. Your scientist will tell you that the ability of air to contain moisture or humidity at 80° to 90° is two or three times that of the same air reduced, or cooled, to a temperature of 40° or 45°. This has largely added to the success of shipments in refrigerator cars.

To assert that fruit leaving California in dry, hot weather must escape the vicissitudes of the climate east of there, is a very careless remark. One who has crossed the continent, even in a Pullman car, knows that the changes of temperature between mid-day and midnight are very great, and also between the high elevations and the low valleys other changes of temperature take place. In ventilated cars all these changes of temperature effect a change of temperature for the fruit, while shipments in refrigerator cars avoid these frequent changes, giving and adding to the life of the fruit when taken from the car. By life, we mean the keeping qualities of the fruit after it leaves the car.

FRUIT STEAMERS.

There are now, says *Scribner's Magazine*, about ninety steamers in the tropical fruit trade between the United States and the American tropics, the carrying of bananas forming the bulk of the business. The Norwegian flag predominates. The vessels are built of steel, wood lined, the space between the steel shell and the wood lining being filled with charcoal. They have three decks, all open, with a space of about two inches between each of the deck planks. This arrangement assures a free circulation of air at all times, and thus the fruit is preserved from heating and decay. These ships carry from 15,000 to 25,000 bunches of bananas, each bunch averaging in weight from sixty to eighty pounds, but some bunches have been found to weigh over 200 pounds. The bunches are placed on end along the decks, until all the space is filled; then a second and a third tier of bunches are laid flat, one over the other, in a manner that allows plenty of ventilation. Great care is taken to prevent the fruit from contact with salt water, which causes the black spots frequently seen on the bananas.

Besides these "tramp" vessels, so to speak, there are also three or four regular steamship lines which are largely engaged in the tropical fruit trade. The principal lines are the Atlas line, the Pacific Mail, the Anchor line, and the Honduras and Central American line. The vessels of the Atlas line are fitted with the most modern appliances for the preservation of the fruit. All these lines have excellent passenger accommodation, and carry a general cargo as well.

The Mediterranean fruit trade requires a large fleet of steamships during the autumn and winter months. Oranges, lemons, limes, Malaga grapes, raisins, currants and nuts form the bulk of the cargoes. Sicily alone sends us 1,000,000 boxes of oranges a year, and half as many boxes of lemons. Spanish grapes, to the amount of 600,000 barrels annually, and dried fruits in vast quantities from the various Mediterranean ports make up an enormous import trade. There are no steamships specially devoted to this business, as the season lasts only a portion of the year. The vessels employed are steamships which are well ventilated, and having a good rate of speed, as they all, or nearly so, carry passengers and a general cargo.

The Florio line, the Mediterranean fleet of the Anchor line, and the Mediterranean and New York Steamship Co. handle nearly all of this class of trade.

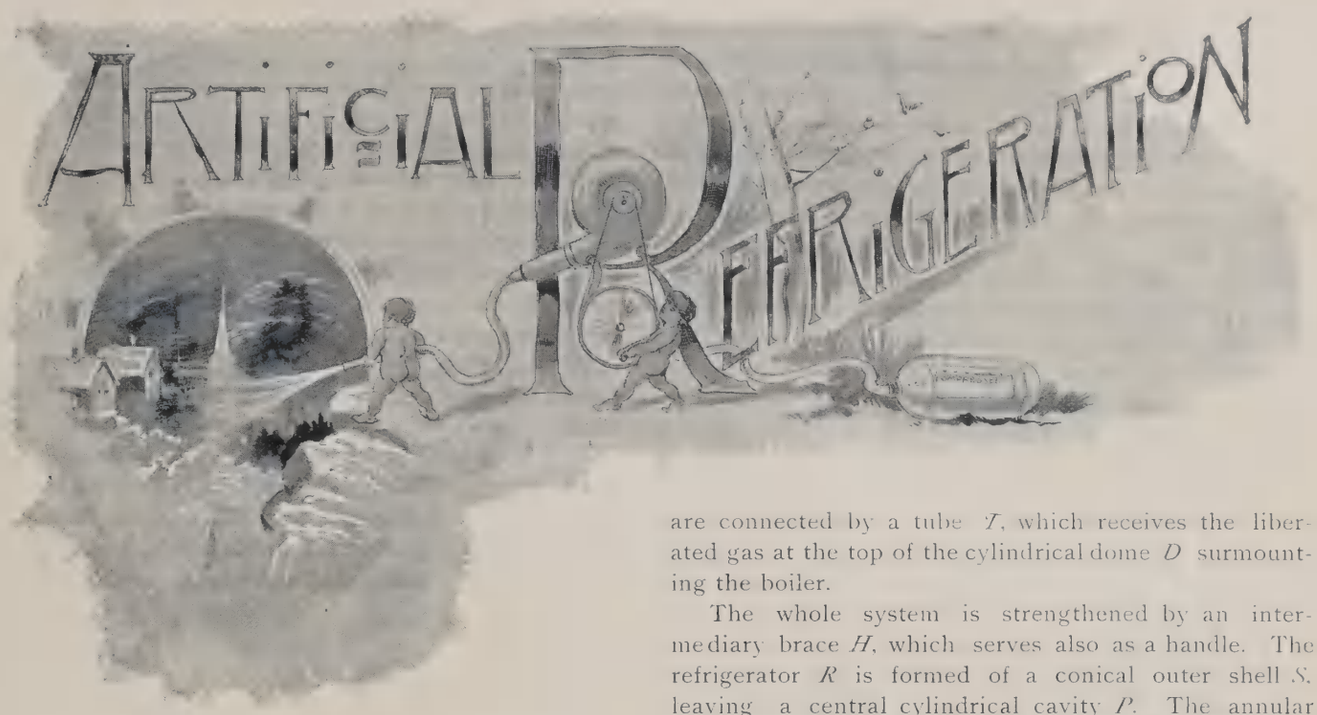
THE WEATHER.

——The first snow of the season at St. Louis fell November 13; at Chicago, 14.

——The Cannon river, at Northfield, Minn., was frozen over November 13 with one inch of ice.

——On November 11 some of the counties of middle Wisconsin experienced a snow storm that was quite severe for the season.

——Cold weather is rapidly making itself felt in all sections of the northwest, and frequent snow storms and heavy freezes are reported.



[*Written for* ICE AND REFRIGERATION.]

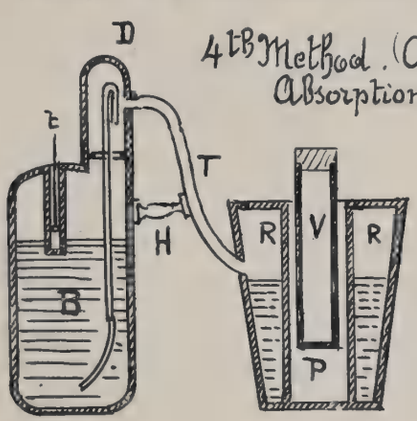
ARTIFICIAL REFRIGERATION.

A CHRONOLOGICAL STUDY OF ITS DEVELOPMENT—THE ICE MAKING MACHINES OF F. CARRE—HIS APPARATUS AND PRINCIPLES DESCRIBED.

BY AUGUSTE J. ROSSI, B. S., C. E.

[*Continued from November issue, page 203.*]

Following these typical inventions, we find for a number of years numerous patents of a greater or lesser importance and value, bearing on mechanical improvements in the preceding machines, or relating to the better use or application of the cold produced; and we have to reach the year 1860 to find the application of a new principle to artificial refrigeration (fourth method mentioned in our classification). It is due to F. Carré, of France.



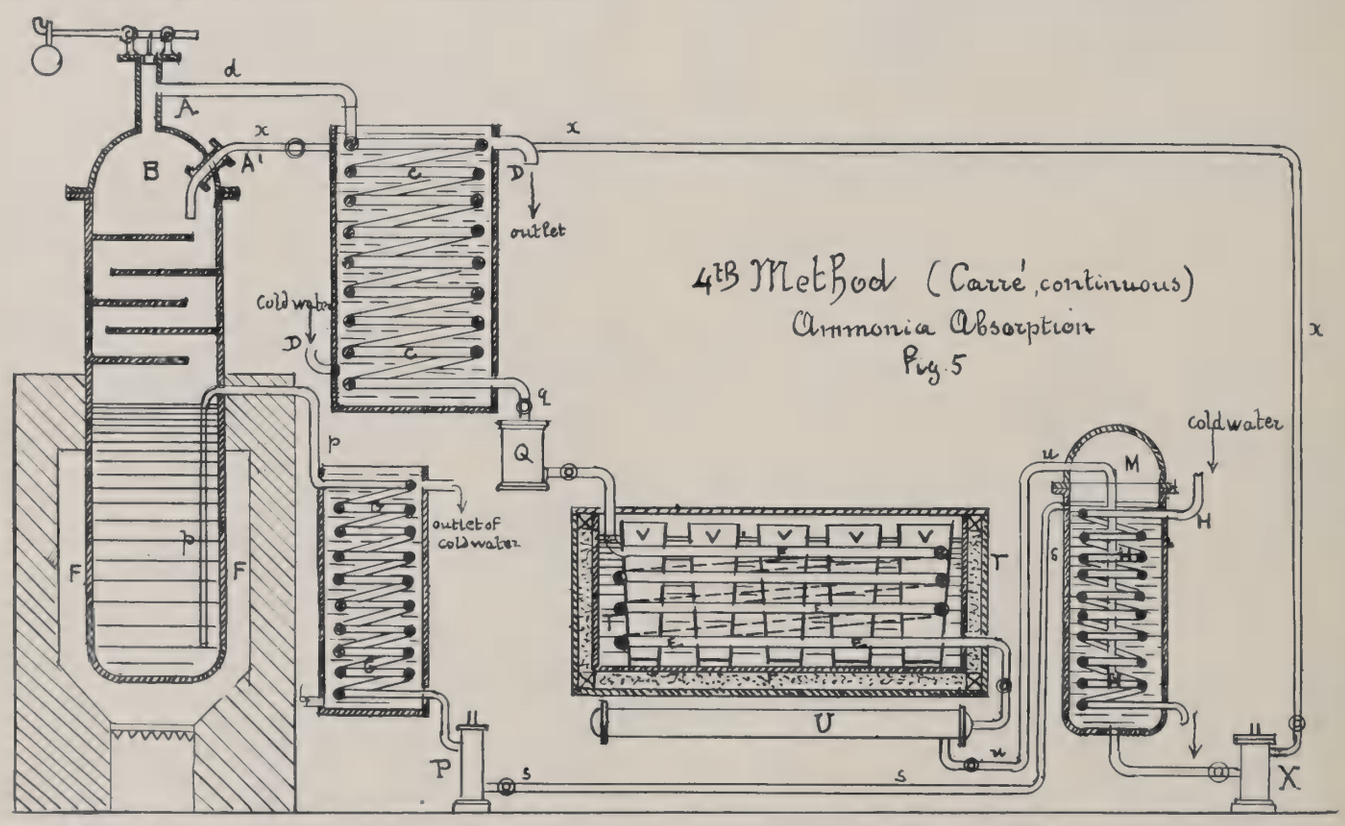
In its principle and mode of operation, the apparatus is a reproduction of the experiment of Faraday with the bent tube, as described previously. The difference lies in the form and in the substitution of aqua ammonia in place of chloride of silver as an absorbent of the ammoniacal gas. The two bent extremities of the tube are replaced by a boiler *B*, and a refrigerator *R*. The machine is intended only for operations on a small scale, the largest product being about five pounds of ice per hour. It is, therefore, portable. The boiler and refrigerator are connected by a tube *T*, which receives the liberated gas at the top of the cylindrical dome *D* surmounting the boiler.

The whole system is strengthened by an intermediary brace *H*, which serves also as a handle. The refrigerator *R* is formed of a conical outer shell *S*, leaving a central cylindrical cavity *P*. The annular wedge-shape space between the can and the cylinder forms also the condenser, which is to contain the liquefied ammonia. In the cavity *P* is placed the vessel, or can *V*, containing the water to be frozen, a vessel which practically fits the cavity *P*, but to insure a better contact between the sides of the can *V* and of the cavity *P*, a small quantity of an uncongealable brine is poured in *P*, so that when the vessel *V* is placed in it, the liquid reaches to the top of *P*.

t is a thermometer to observe the temperatures. When operated, the boiler *B*, filled with strong aqua ammonia, is heated by means of a small portable furnace. The heat driving the gas ammonia from its solution, the gas reaches through *T*, the condenser and congealer *R*, which is immersed in any kind of a tank or box containing water at ordinary temperature, which can be renewed if necessary. Under the cooling and the pressure at which the gas ammonia escapes from the solution, it is liquefied, and fills the conical part of the vessel *R*. The source of heat is then removed from the boiler *B* and the apparatus being lifted bodily by means of the handle *H* and turned end for end, the boiler is dipped in its turn in the cold water bath. The temperature of the boiler rapidly falls down, and as it does so the power of the weakened solution it contains to re-absorb ammoniacal vapors is restored. The condensed gas ammonia of *R* begins then to evaporate rapidly from the congealer, the vapors being absorbed as fast as formed by the liquid of the boiler; an intense cold is thereby produced, and which ultimately freezes the water in the mold *V*. To protect against loss by radiation the congealer *R*, during this stage of the operation, is surrounded by a non-conducting envelope. The ammonia solution in the boiler by this reabsorption of the gas ammonia is thus restored to its original strength and is ready for another operation.

In 1865, Mr. F. Carré patented an apparatus based on the same principle, but of which the operation was continuous. At the French International Exhibition of 1867, he had in operation a machine of this type which could produce regularly six tons of ice in twenty-four hours, practically and economically. This machine has been the basis of all the ammonia absorption machines

of our day. Improvements have certainly been made in the constitutive parts to increase their efficiency or to adapt them better to their contemplated use, but the mode of operation has remained the same : the general features of the process have been preserved. Like the intermittent process, this continuous process depends for its efficiency upon the evaporation of strong ammonia solution. Aqua ammonia is introduced in a special boiler *B*, properly built in a stationary furnace *F*, of elaborate construction, and the gas is expelled by heat in the condenser *C*, coil or tubular vessel, cooled by a circulation of water *D*; but, in order that the process may not be arrested by the exhaustion of the solution, as in the intermittent type, the impoverished liquid is gradually withdrawn from the bottom of the boiler *B* through the pump *P* and pipes *p p*, while a proportionate quantity of fresh and strong solution, reconstituted, as we will see further, is constantly supplied at the top at *A*. As the gas ammonia is disengaged, under pressure, from its solution by heat, it is condensed in *C* by the combined effect of this pressure and of the cooling action of the circulating water of the condenser *C*. The liquefied ammonia passes then through the pipes *q q* into a receiver *Q*, and from *Q* into a special apparatus called the expander, or refrigerator *E*, adapted for such purpose; such, for instance, as a series of parallel coils *E E* placed in an insulated tank *T* filled with strong brine, in which are placed the vessels *V V*, containing the water to be frozen, the flow of the liquid ammonia in coil *E E* being regulated by proper cocks. There the liquefied ammonia gas evaporates spontaneously, producing an intense cold which is applied to freeze the water in the molds by contact with the brine, or for cooling this brine for any other purposes of refrigeration. As the boiler *B* and the condenser *C* keep up a constant supply of liquefied gas ammonia, the refrigerator *E E* will continue to freeze or produce cold as long as the fire is maintained under the boiler. The ammonia gas escaping from the refrigerator, or expanding coils *E E*, is collected in a vessel *U*, from which it arises in what is called the absorber *M*, a vessel in which is also admitted, through pipes *S S* some impoverished solution drawn from the boiler and previously cooled, as it is withdrawn from it by means of the pump *P* by its being passed through a system of coils *b b*, immersed in circulating water: this cooling is done to restore the power of further absorption of the weakened solution. To promote the reabsorption of this gas ammonia from *E*, by the cooled impoverished solution of the boiler, supplied in *M* and with which it intermingles, the mixture is cooled during the process of absorption which generates heat by means of a circulation of water in the coils *H H* placed in the absorber *M*. The gas ammonia being thus reabsorbed in *M*, and the original strong solution there constantly reformed, this solution is pumped back in the boiler by the pumps *X X* through the pipes *x x x* and delivered in the boiler at *A'* to be again evaporated. In the Carré machine the heat of the weakened solution withdrawn from the boiler, previous to its being further cooled by the coil *b b* was made available to warm up to a certain extent the resaturated solution re-formed in the absorber *M* as it is pumped back in the boiler, and in its return to said boiler a special contrivance, not shown in the figures, being used for such purpose. Though an excellent feature, as far as economy of heat is concerned, it is not an essential feature of the process, and for this reason we have omitted it, so as not to complicate unduly the figure, which, like all the others which illustrate other processes, are "schemes" embodying the *modus operandi* of each system, without references to the details of construction of the different parts.



In subsequent patents it has been proposed to substitute for a solution of gas ammonia in water a solution of another gas, such as sulphurous deoxide in a liquid, the oxalic ether. This ether has a boiling point at 370° F., and it absorbs sulphurous deoxide gas at the ordinary

temperature to the extent of its own weight, gas which it abandons readily by being heated (Lessie du Motay and A. J. Rossi, 1880); but the mode of operation of the apparatus is the same, the machine of the same type, based on the same principle.

[TO BE CONTINUED.]

[*Written for* ICE AND REFRIGERATION.]

THE COST OF REFRIGERATION.

CONTINUATION OF A DISCUSSION ON THIS IMPORTANT TOPIC—OBVIOUSLY AN APPROXIMATE ESTIMATE ONLY CAN BE OFFERED—QUESTION OF EFFICIENCY.

BY A. J. ROSSI, C. RASSBACH AND J. K. KILBOURN.

In answer to the query asking for the "expense per twenty-four hours of refrigerating a room containing 1,000 cubic feet, at a temperature of 37° F., the outside temperature being 74° F.," I have this to suggest: Your correspondent omitted many points which are essentially required before any satisfactory answer can be given, to wit: What does he desire to refrigerate? How rapidly does he desire to cool it? Is the room to be supposed to be insulated or not? Has it any windows? If insulated, how completely? Are any materials containing animal heat, such as freshly slaughtered cattle, or the like, to be stored in it or not? The room once filled, are the materials to be renewed in the twenty-four hours and replaced by others? And if so, how much of them?

For lack of direct information, *assuming* the room to be tolerably well insulated, and treating it as a brewery cellar or fermenting room, or the like, it can be considered as a safe practice to reckon upon 15,000 to 16,000 cubic feet of *such cellars* being maintained cooled in twenty-four hours by a machine capable of producing *one ton of solid* ice in that time. This gives for 1,000 cubic feet about one-fifteenth to one-sixteenth of a ton, or nearly 125 pounds of machine-made ice in twenty-four hours. Now, owing to allowances made in manufacturing *ice* by machinery, on account of ice melted in loosening the cakes from the molds, loss of cold in freezing tanks, by radiation and otherwise, temperature of water used to make ice, and other causes of a technical order, it is usual to reckon one ton of *machine-made ice* (the cold corresponding to such production of ice is not the object in view) as equivalent to the cold produced by the melting of 1.70 to 2 tons of natural ice. Hence, for maintaining cooled a space of 1,000 cubic feet, supposing such insulation as is used in brewery cellars or fermenting rooms, and assuming the material contained to be treated as those contained in such cellars and rooms, we may reckon on an expense of 250 pounds of natural ice per day, more or less, according to circumstances. Of course, with such a quantity of ice required, an ordinary ice machine would be out of the question; at least any one using special machinery. I could suggest other means, however, if it were an object for your correspondent.

A. J. ROSSI.

Will you kindly give in your next issue, the expense per twenty-four hours of refrigerating a room containing 1,000 cubic feet at a temperature of 37°, the outside temperature being 74°?

While the question appears to ask specifically for the expense of refrigerating 1,000 cubic feet of space as a single room and not as a part of an entirety of a larger room, yet no mention is made in regard to the DIMENSIONS of this room containing 1,000 cubic feet of space, the quality of its insulation, or the manner in which it is accessible and how OFTEN and how LONG it will be open for access.

With the absence of more definite statements of this character, we must confine ourselves to rendering such *data* and *formulæ* as will enable those interested to determine, for any given case of a distinct character, the amount of cold generated for the required refrigeration, and thereby ascertain the cost according to prices of ice, fuel or machinery for mechanical refrigeration.

In the general practice of mechanical refrigeration a machine of 25-tons refrigerating capacity is considered sufficient to maintain a temperature of 37° F. in a compact and modern built cold storage house of 500,000 cubic feet of space, when the outside atmosphere does not exceed 74°. Under average conditions as to wages, prices for fuel and water, the running expenses for refrigerating such a space will not be more than $25 per day, or five cents per 1,000 cubic feet of space during twenty-four hours.

The cost of cooling smaller rooms will exceed this figure by far. First, because the exposed surfaces increase proportionate to the square of the dimensions of a room, while the space increases in proportion with the cube; and, second, because small cold storage rooms or refrigerators, as a rule, are not insulated as well as large buildings heavily loaded.

The amount of cold required for maintaining a low temperature in a given space, excluding anything requiring additional refrigeration, mainly depends upon how much heat will penetrate the surrounding walls, floor and ceiling, which has to be absorbed by the refrigerant.

Be: N=the number of heat units penetrating 1 square foot of surface for every 1° F. of difference of temperature.

C=a co-efficient depending upon the heat conducting ability of the material of which the walls are built.

$t-t_1$=the difference of temperature between the inside of a room and the outside atmosphere; and

e=the thickness in feet of the walls or insulating material by which the room is surrounded; then the formula

$$N=\frac{C(t-t_1)}{e}$$

will apply for determining the number of heat units to be absorbed for every square foot of surrounding surface.

If the walls are built from different materials, such as brick, lining of wood, paper, etc., etc., the thicknesses of which are respectively e, e_1, e_2, etc., while the corresponding heat conducting coefficients are C, C_1, C_2, etc., the above formula will change into:

$$N=\frac{t-t_1}{\frac{e}{C}+\frac{e_1}{C_1}+\frac{e_2}{C_2}+\cdots\cdots\cdots\cdots}$$

Careful experiments and practical tests as to the heat conducting properties of different materials have rendered the value of C as follows, to wit:

For pine wood across the fiber	$C=0.084$
" mineral wool	$=0.068$
" granulated cork	$=0.0537$
" wood ashes	$=0.0403$
" sawdust	$=0.0437$
" charcoal, powdered	$=0.053$
" cotton	$=0.0268$
" soft paper felting	$=0.0228$

For solid brick walls of usual thicknesses the following table gives the value of the quotients $\frac{c}{e}$ and $\frac{e}{c}$.

For brick walls of	9″	13″	18″	22″	thickness,
$\frac{c}{e}$	0.395	0.298	0.2375	0.204	
we have $\frac{e}{c}$	2.53	3.355	4.21	4.9	

while for air-tight double floors of wood properly filled underneath, so that the circulation of the atmosphere is excluded, and for ceilings of like construction, the value of $\frac{c}{e}$ = 0.082 is near to practical results.

It is a well known fact that an air space between two walls is generally considered among the best insulating means, providing that such air spaces are hermetically sealed against the atmosphere inside or outside of the room to be refrigerated. The reason for this becomes apparent from the above formula, if we take into consideration that an air space between two walls will possess an average temperature between the inside and outside atmosphere, and that, therefore, each of the insulating walls is only exposed to a fraction of the prevailing difference of temperature.

A room containing 1,000 cubic feet of space, if built with square walls, will have a minimum exposed surface of 400 square feet, and an additional surface of 200 square feet for the floor and ceiling.

Providing this room is surrounded by plain brick walls of 9″, 13″, 18″ and 22″ thickness respectively, we would obtain:

$$N = \frac{C}{e}(t-t_1)\times 400\times 24, \text{ or}$$

$$N = \begin{Bmatrix} 0.395 \\ 0.298 \\ 0.2375 \\ 0.207 \end{Bmatrix} \times 37\times 400\times 24$$ as 37° is the assumed difference in temperature of the inside and outside atmosphere.

This will result in:

$$N = \begin{Bmatrix} 140{,}000 \\ 105{,}850 \\ 84{,}350 \\ 72{,}500 \end{Bmatrix}$$ calories per 24 hours.

The amount of heat conducted through the floor and ceiling will be

$$N_1 = \frac{C}{e}(t-t_1)\times 200\times 37 = 0.082\times 37\times 200\times 24 = 14{,}500 \text{ cal.}$$

so that the aggregate heat to be absorbed either by ice or mechanical refrigeration will amount to:

$N+N_1$ = 154,500, 120,350, 98,850 and 87,000 heat units respectively.

As one pound of ice when converted into water of 37° will absorb 147 heat units, the weight of ice required for maintaining a temperature of 37° in the proposed room of 1,000 cubic feet of space when the outside atmosphere is 74° will be 1,050 lbs., 820 lbs., 672 lbs. and 592 lbs., respectively, from which everybody might derive the expense in dollars and cents, according to what he has to pay for ice.

Providing, however, that the brick walls were lined with a double thickness of tight boards with felt paper between, the result would be:

$$N = \frac{37}{\frac{e}{C}\begin{Bmatrix} 2.53 \\ 3.355 \\ 4.21 \\ 4.9 \end{Bmatrix} + \underbrace{\frac{0.0834}{0.084}}_{\frac{e_1}{C_1}} + \underbrace{\frac{0.00328}{0.02283}}_{\frac{e_2}{C_2}} + \underbrace{\frac{0.0834}{0.084}}_{\frac{e_3-e_1}{C_3-C_1}}} = \begin{matrix} 75{,}800 \\ =64{,}700 \\ 56{,}000 \\ 50{,}500 \end{matrix}$$

With floor and ceiling of the same quality as stated above, the aggregate heat passing from the outside through the walls per twenty-four hours would be 90,300, 79,200, 70,500 and 65,000 calories, respectively, requiring 615 lbs., 540 lbs., 480 lbs. and 443 lbs. of ice to obtain the desired result.

For a double wall consisting of 13″ and 9″ in thickness, with an air space between, we would have:

$$N = \frac{t-t_1}{\frac{e_1}{C_1}+\frac{e_2}{C_2}} = 60{,}300 \text{ cal., against } 72{,}500 \text{ cal., for a solid wall of } 22'' \text{ in thickness.}$$

If the room is made accessible through a vestibule, with doors closing tight both ways, the loss of cold whenever the room is opened will amount to an equivalent of about two lbs. of ice.

The application of mechanical refrigeration for so small a space would be too expensive at the present undeveloped stage of small machinery, while the generating of cold by dissolving salts or compounds of salts and acids in water might result in economy and satisfaction where ice is obtained only at extraordinary prices.

C. Rassbach.

THE MATTER OF EFFICIENCY.

In the very interesting and instructive "estimate" of Mr. John E. Starr, page 283, November number of Ice and Refrigeration, he gives the efficiency of ice at 142 B. T. U. per pound.

This is the theoretical efficiency; but I would like to ask him, or any of your correspondents, if he, or they, have ever made any experiments to determine the actual efficiency in practical work of natural ice that has been cut and stored?

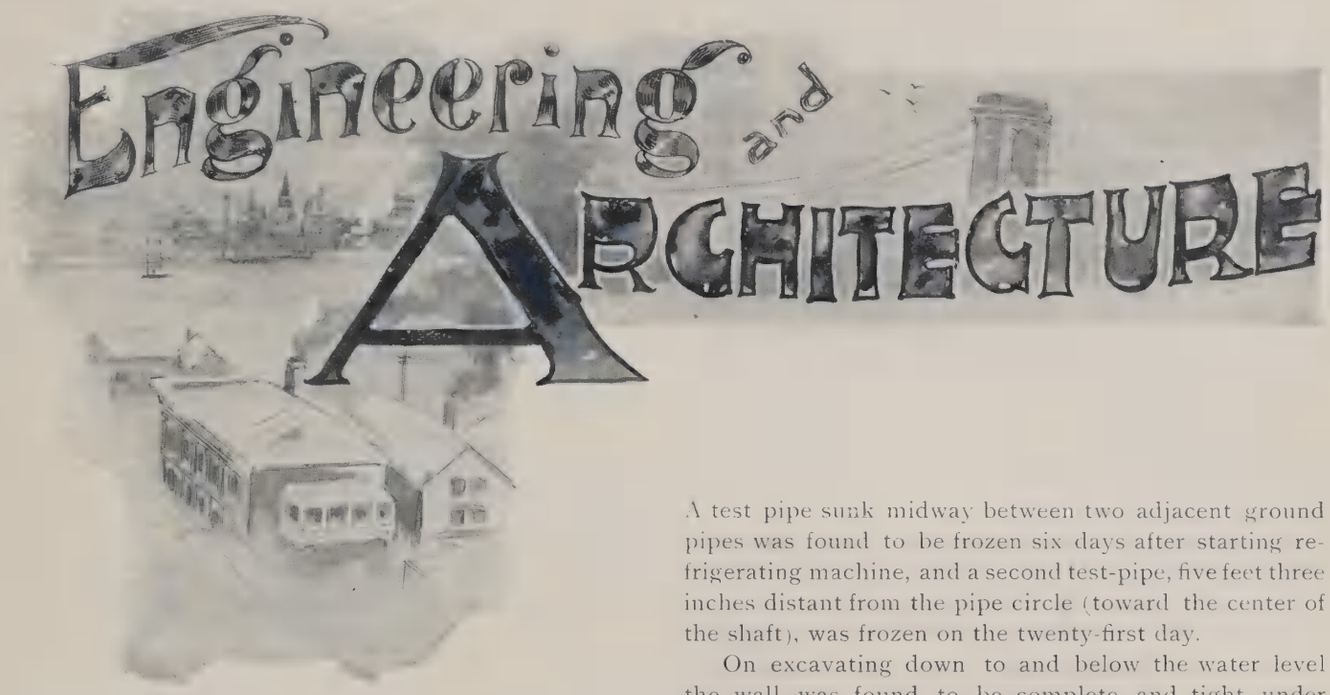
My own observations lead me to the conclusion that theoretical efficiency is never attained except in the laboratory. One instance that came under my observation was at a large brewery in London, where eighty tons were melted in a large wood tank containing a known quantity of water; the beneficial results obtained were less than two-thirds of theoretical efficiency. In another brewery in London it was found that melting six tons of ice gave a less beneficial result than four tons of refrigeration.

This matter was discussed at one of the meetings of the civil engineers at Westminster, without arriving at the cause of this admitted discrepancy.

An account of any experimental tests as to the beneficial efficiency of melting commercial ice in practical work would, I am confident, be of interest to very many of your readers.

J. K. Kilbourn.

Talking of hailstones, the "curio" fiend of the St. Louis *Republic* has discovered two which take the first two prizes. The first was reported by the Waltham *Register*, July 15, 1823, as having fallen about that time at Munson, Mass. The appearance of the mass was said to be that of a compact body of hailstones as firmly united as ice usually is: extremes, four feet long, three feet wide, and two feet thick. After removing the rough part of the body there remained a solid, clear block of ice two feet three inches long, one foot and six inches wide, and one foot three inches thick. The other is said to have fallen at Salina, Kas., in 1881. It was about the size of a nail keg, and weighed eighty pounds. It is curious that both should have fallen in warm or hot weather.



[*Reprinted from the School of Mines Quarterly.*]

REFRIGERATION AND ENGINEERING.

THE FREEZING PROCESS AS APPLIED AT IRON MOUNTAIN, MICH., IN SINKING A SHAFT THROUGH QUICKSAND.

By D. E. Moran.

[*Continued from November Issue, Page 267.*]

Results of Refrigeration.—On starting the refrigerating machine and the circulating pumps the temperature of the brine fell rapidly at first, and then more gradually, until a minimum was reached, after which it very slowly rose until the completion of the shaft. The fluctuations of the temperature of the brine returning from the ground pipes are shown graphically on the accompanying progress diagram. The temperature of the brine entering the ground pipes was nearly constantly 1° C. lower. The temperature, as shown, cannot be relied on as absolutely correct, as the thermometer used for a part of the record was lost by the parties to whom it was sent for comparison.

The record shows a connection between the temperature of the brine and the atmospheric temperature, which is due to the effect of the latter on the cooling water.

The loss above ground in the connecting pipe, due to the heating effect of the atmosphere, is shown by measurements taken on a subsequent work to be inconsiderable. The effect of the atmosphere on the temperature of the cooling water is, on the contrary (and as to be expected), of the greatest importance.

The effect of starting the ice machine and the circulation of brine was immediately apparent. The ground froze around each pipe, forming cylinders (or, as they were afterward found to be, cones), which increased in diameter until adjacent cylinders intersected, thereby forming a continuous circular wall extending from the surface of the ground to the underlying rock, and constituting a coffer-dam inclosing the proposed shaft. The rate of freezing around the shaft was substantially uniform, according to surface indications. A test pipe sunk midway between two adjacent ground pipes was found to be frozen six days after starting refrigerating machine, and a second test-pipe, five feet three inches distant from the pipe circle (toward the center of the shaft), was frozen on the twenty-first day.

On excavating down to and below the water level the wall was found to be complete and tight under pressure, and no water at any time came through the frozen wall, although, as subsequently to be described, water did find its way through the rock ledge, and finally between the ledge and the base of the frozen wall. As the excavation progressed the diameter of the core of unfrozen material in the center of the shaft decreased. This was due primarily to the difference in elapsed time, but also in some degree to an effect of the method of circulation. The brine being introduced through a small pipe in the center of the 8-inch ground pipe, reached the bottom at nearly its initial temperature, so that the lowest temperature, and consequently the greatest freezing effect, was at the bottom of the pipe. With a nearly constant difference of only 1° C. between the top and bottom of the pipes, there was a marked difference in the distance frozen, as determined at the completion of the work by means of a small trial shaft sunk on the outside of the wall to a depth of twenty feet. From the bottom of this shaft a steel bar was driven down ten feet further, following the frozen material, and for that depth there was shown to be a nearly uniform batir of about one in fifteen. It was not determined, however, that this increased thickness was due to this cause alone.

It is apparent that this difference in temperature between top and bottom of the pipes, and probably the extent of this coning, could be regulated by varying the rate of circulation. There is a theoretical advantage in the cone form, as the pressure on the frozen wall increases directly with the depth. On the other hand, the difficulty of excavation increases as the wall thickens and the unfrozen core diminishes in diameter.

The rate of freezing varied in different materials, according to the amount of water contained. Several careful experiments gave 17 per cent of water in the fine sand. Where gravel or boulders were imbedded in the sand, this percentage was largely decreased, and the distance frozen was correspondingly greater.

The effect of the water can be seen from the following approximate calculation of the number of heat units required to reduce the temperature of one cubic yard of saturated quicksand from 10° C. (50° F.) to —15° C.

(5° F.) limits which agree with practice for material in close proximity to the freezing pipes.

	Pounds.
1 cubic yard of saturated sand, as determined by experiment, weighs	3,360
Weight of water, 17 per cent.	= 571
" " sand, 83 " "	=2,789

Specific heat of water, =1.0
" " " sand, =0.2
" " " ice, =0.5
Latent " " " 80 C., lb. h. u.

Heat units abstracted from the sand,

Weight. Specific Heat. Range of Temperature. C. lb. h. u.
2,789 × 0.2 × [10° —(—15°)=25°] =13,945

Heat units abstracted from contained water,

1. To raise to 0° C.,
   Weight. Specific Heat. Range of Temperature.
   571 × 1.0 × 10° = 5,710
2. To freeze,
   Weight. Latent Heat.
   571 × 80 . . . . =45,680
3. To reduce to —15° C.
   Weight. Specific Heat. Range of Temperature.
   571 × 0.5 × 15° = 4,282

Total, ... =55,672

SUMMARY.

Heat units in sand=79.97 per cent,	=13,945
Heat units in contained water=20.03,	=55,672
Total,	=69,617

Or, the water in the sand consumes nearly 80 per cent of the refrigerating effect. If, then, the sand be replaced in part by material not containing water, the work of freezing will be proportionately reduced.

The above figures do not, in any degree, represent the amount of freezing effect required to produce a cubic yard of frozen wall in practice. Beside the loss due to radiation above ground, the following causes produce greater or less losses.

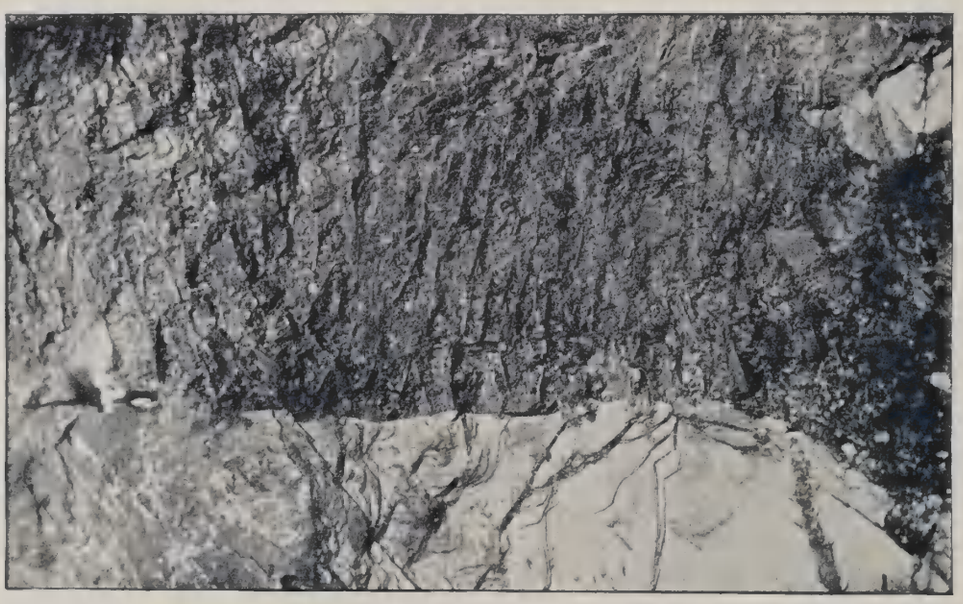
1. Conduction from subterranean sources of heat.
2. Conduction from surface.
3. Flow of subsoil water.

It must, moreover, be remembered that the work of refrigeration, as distinguished from the work of freezing, includes the cooling of a quantity of material beyond the limits of the frozen wall. The proportion of the work beyond the 0° C. line to the entire work, in any case, will depend on the rate of conduction through the soil, to the extent to which freezing has progressed, and to the rate of freezing.

Considering the case of a single pipe, it is evident that, for a given capacity of ice machine, there will be a constant number of heat units to pass through each square foot of surface of pipe on the supposition that the capacity of the refrigerating machine remains constant at different temperatures, and that the work is evenly distributed in the pipes. If there were no losses, the amount of sand frozen should, in general, vary with the time or the distance from center of pipe with the square of the time.

In the same case, the temperature of the brine should vary inversely, as the thickness of the wall or as the square root of the time.

When the freezing action of the different pipes begins to co-operate, the above relations change, and the rate (average of inside and out) of freezing becomes more rapid. It then, theoretically, remains constant until the interior of shaft becomes frozen solid, when the entire work of the machine is outward and the total pipe area can be considered as acting outward from the line of the pipe circle.



JUNCTION OF FROZEN QUICKSAND AND ROCK LEDGE, TAKEN NINETY FEET BELOW THE SURFACE.

The above expressions are not to be taken as anything more than general, as the problem is really very complicated, involving a discussion of the conduction of heat (or cold) from several sources, through a medium whose conductivity changes greatly at one point (0° C.) and in which the presence of water requires that its latent heat shall be taken into account, which latent heat, must, moreover, be considered as being developed at the constantly varying limit of frozen ground.

Characteristics of Frozen Quicksand.—The character and strength of frozen sand will probably be found to vary with different sands. The sand at Iron Mountain was very fine, and to the eye and touch it seemed to be composed of grains of fairly uniform size, without sharp edges. Under a low power microscope, however, the size of the grains is seen to vary from a maximum of about $\frac{1}{64}$

of an inch for the greatest dimension down to what still appears under the glass to be a mere speck. The angles of the grains appear as sharp as in ordinary building sand, but the grains do not appear clean, and there is a slight tendency to cake. A sample taken from the center of a lump, as excavated, and tested for size of grain, gave the following results:

One hundred grammes were weighed, and of this

1.8	grammes	were	stopped	by an	80-mesh	screen.
2.0	"	"	"	"	100 "	"
26.6	"	"	"	"	190 "	"
68.7	"		passed	"	190 "	"
.9	"	"	lost.			
100.0	Total; or nearly 70 per cent passed a 190-mesh screen.					

Tests were made during the progress of the work to determine the strength of this material when frozen. Briquette molds were filled with saturated sand, and frozen, the resulting briquette being kept at a low temperature until tested. An ordinary Fairbanks cement tester was used for both tensile and compressive tests. The compressive tests were limited by the size of the machine to one-inch cubes, which were formed roughly by the same method as used for the tensile strength briquettes. The tests were made in a cold room, but the temperature of the test pieces was not determined, nor is it known what effect, if any, the degree of cold, below 0° C., has on the strength of the material. The results were as follows:

	Tensile Strength
Average of four tests,	431 pounds per sq. inch.
Maximum result,	491 " " " "
	Compressive Strength
Average of eight tests,	575 pounds per sq. inch.
Maximum,	880 " " " "

Frozen quicksand can be regarded as a mortar in which the cementing material is ice, and, as in a cement mortar, the strength will probably be found to depend on the quality of the sand and the presence of sufficient cementing material, as well as on the strength of the cement.

Frozen quicksand looks like a fine-grained sandstone. It is perfectly homogeneous, breaks with a tendency to conchoidal fracture, and is as hard to work as a stone of similar character. When mixed with gravel or boulders the mass resembles conglomerate or a concrete made with similar stone. The difficulty of working the material is more than doubled by the presence of gravel, which greatly increases its tenacity and dulls the pick points or "moils" of the miners. The strength with which the quicksand adheres to the stone is shown by the line of fracture in such material. There seems to be no tendency for the rounded boulders to pull out of the quicksand, but rather for the break to follow the shortest line, whether through flint or quicksand.

When exposed to air of a temperature below freezing, the surface of detached pieces of frozen quicksand becomes sandy from the dry evaporation of the ice. This process goes on very slowly, and is not apparent where the surface forms part of the frozen wall, as its temperature then is generally sufficiently below the dew point to cause a deposition of frost on all exposed surfaces. In the same way when the shaft was flooded the exposed surfaces, instead of being disintegrated by contact with the water, were soon coated with ice, and on pumping out the entire interior of the shaft had a remarkable aspect—the general effect being as if the rough timber and surfaces of excavation had been heavily varnished.

(TO BE CONTINUED.)

SHOOTING ARTESIAN WELLS.

The Consumers' Ice Co., at Chester, Pa., recently exploded 100 pounds of dynamite at the bottom of their artesian well, 470 feet deep, with the view of increasing the flow of the well. At our last advices the well was so choked with *debris*, which had to be removed by the drill, that no estimate could be made of the effect on the flow. The experiment, we hope for their sakes, was a success, but it is a hazardous one to make; for we have in mind an Illinois well of nearly the same depth (about 430 feet), which was treated in the same way, with the same end in view, the result being that within an hour the flow of the well, which had been sixty to eighty gallons per minute, began to decrease, and within a very short time ceased altogether. The well was completely destroyed. The destruction of this well was no doubt due to the fact that the explosion created fissures through which the water escaped below the surface, which deep tubing might or might not have remedied, the usual practice, at the locality named, being to tube only about 120 feet, or to the hard lime rock which overlies the very porous water-bearing sandstone. However, the shooting of an artesian well was never, to our knowledge, repeated in that part of Illinois.

FREEZING SALMON.

The freezing of salmon at the Pacific coast salmon streams has become quite a business this season, the run of fish having been so great that the canning factories could not handle all the fish offered. Never were the fish so plenty or so cheap. But the natives soon found out a thing or two, and after the canneries ceased buying, the fish were taken to the ice factory at Whatcom, and as the Inca (so says the legend) heaped a chamber with gold to secure his liberty, so are the natives heaping high the cold storage rooms in the city with the fat and red-blooded silver salmon to secure their winter's provisions. On the platform of the long wharf at all hours of the day, during October, were huge stacks of these magnificent fish, ranging in weight from six to ten pounds. These were gutted and packed in the tin cans in which the ice is made, and then taken to the freezing room. Here they remained twenty-four hours. When taken out, the fish were as hard as a rock, and frozen into bundles. They were then pitched into a wheelbarrow and taken to a cold room, where they will remain until marketed during the winter. In tossing them into a wheelbarrow very often a frozen tail or head was broken off, showing the brittleness of the freeze. Many thousands of fish have been corded away, or say, twenty to thirty tons. These fish cost 1½ cents per pound, and will be sold in the East at the price of the choicest steaks, netting a handsome profit.

Ice is all but indispensable to the dairy man for bringing his milk and cream to, and keeping them at, the proper temperature; and every truly successful dairy is provided with an ice house (or should be) of a size in proportion to the business done by the dairy. For dairy purposes the ice house is comparatively inexpensive, and may be built on lines proposed heretofore in Ice and Refrigeration. It might be suggested, in addition, that ice should be cut and put up only in freezing weather.

ICE V. MECHANICAL REFRIGERATION.

SOME REMARKS ON THE PROBLEM OF REFRIGERATION AS PROPOSED BY MR. BEEMER IN THE OCTOBER ISSUE—THE MECHANICAL SIDE OF THE CASE.

By Correspondents.



E have received from our correspondents, as below, some remarks on the problem of refrigeration by ice or mechanical means, in relation to the difficulty of securing a *dry* as well as *cold* air in cold storage houses. This topic is one of the very highest importance to cold storage managers, and Ice and Refrigeration gives the views of Mr. Gay and of the Hercules Iron Works in full, as well as those of Mr. J. K. Kilbourn, in the hope of eliciting thereby still further discussion of the problem. Every reader is invited to take part in the discussion, in order to bring out every fact that may tend to develop the best and most economical results. The editor would particularly like to have the views of cold storage men who cool with ice, who probably have the greatest difficulty in securing an absolutely dry atmosphere in cooling rooms.

THE RESULTS OF PRACTICAL EXPERIENCE.

Referring to the question proposed by Mr. Beemer (October issue, page 211), and his premises—that in mechanical refrigeration, "the pipes, being intensely cold, act *for a time as condensers*, gathering the moisture in the room into frost and ice upon their surface"; and further, that when a certain thickness of frost and ice is accumulated on the pipes "their power to freeze moisture out of the room seems to cease."—I would suggest that the volume of ice accumulated in a given period after the brine or ammonia has been "turned on" will be found in nearly all cases to be proportional to the amount of warm and moisture-laden air admitted from the outside. The remedy lies in simply arranging rooms so that in putting in or taking out goods, or in entering the rooms for any purpose, the cooled rooms are not subject to drafts of air from outside. Cooling rooms should open into a tight hallway, the outside door of which should be closed when the room doors are open. From personal experience, I can say that a room properly insulated and well piped can be kept perfectly dry for eighteen months to two years where care is exercised about excluding outside, moisture-laden air.

There are a few instances in which moisture is given off in large quantities by the contents of a room, notably so in case of fermenting rooms of breweries, or rooms used for cooling liquids of any nature in open vessels, but for all practical purposes of general cold storage there is but very little moisture taken up from the material kept in store.

The amount of ice that can safely be carried on pipe surfaces without tendency to drip, will average one-fourth pound of ice per cubic foot of room space, and this gives a great many complete changes of air in a room, without bringing in sufficient moisture to overload the cooling pipes with ice. However, all cold storage piping should have drip troughs and gutters, so that when the frost is to be removed from pipes by shutting the coils off, the water may be carried out of the rooms completely.

The tendency to realize the conditions premised and argued by Mr. Beemer is undeniable, but the tendency can be so checked and regulated as to remove all objectionable results. C. M. Gay.

THE VIEWS OF REFRIGERATING MACHINE MAKERS.

The editor of Ice and Refrigeration asked, among others, the Hercules Iron Works to give us their views upon the question raised by Mr. D. B. Beemer. The "Hercules" people expressed themselves as follows:

Mr. Beemer acknowledges that he only refers to a room held above freezing point, and that where a room is below freezing, the moisture complained of will necessarily be frozen out.

There are very few proprietors of cold storages who will devote themselves entirely to the care of provisions, etc., that can be held at a temperature above freezing. Most cold storage depots will be provided with such complete facilities for work that any and all required temperatures can be given. Some articles require a temperature above freezing, others below, and the temperature must be varied to suit the varied conditions of the goods stored. Meats with a coarse fiber do not require so low a temperature as those of a finer fiber, and, as Mr. Beemer shows, eggs and such like produce must be kept at 34° to 35° F. So that it is an absolute essential in the modern cold storage that it shall be capable of so adjusting its temperatures in different chambers as to give the specific amount of cold which experience has demonstrated each specific article needs to best preserve it. This essential none of the natural ice systems provides for. Where the ice is stored in bulk overhead, or even where side tanks are used, as Mr. Beemer says, it is seldom that a cold temperature can be maintained much lower than 40° F. But in the mechanical refrigeration system it may be 40°, 30°, 20°, 10°, or even zero, if required. The temperature is under the absolute control of the operator. This fact will at once settle the question in the mind of any thinking person who desires to utilize cold storage for a variety of articles where various temperatures are required.

As for a steady temperature, above freezing, ice can be use to advantage, as Mr. Beemer has used it, by introducing the appliances to remove the moisture from the atmosphere caused by the melting of the ice. And when Mr. Beemer makes the supposition that in the mechanical cold system the power of the coils to condense the moisture of the room becomes impaired in a short time after using, he overlooks the following facts, and also shows that he is not familiar with the working of such plants as the "Hercules."

Where ice is used, the ice itself in melting gives out a large proportion of moisture, in addition to that thrown off by the articles stored. Thus is a constant, never ceasing stream of moisture given to the atmosphere just so long as there is ice to be melted.

But in the mechanical system, the only amount of moisture to be absorbed is the trifling amount given out by the stored articles themselves, and with an ordinary amount of pipe, absolute dryness is thereby assured.

Ice has a limited amount of efficiency, beyond which it is incapable of working. Suppose, for instance, a storage cooled with ice, containing 1,000 cases of eggs. The ice may successfully perform its work on this number, though it will be necessary, as Mr. Beemer has found it, to have the extra condensers to remove the moisture. But the chamber has capacity enough for another 1,000 cases, and these are also stored. It will at once be apparent that 2,000 cases will necessarily require more cold than 1,000, and also more moisture-condensing power, for there is twice the amount of caloric, and twice the amount of moisture given out. The result would be—in the ice system—that as soon as the surfaces of the ice tanks had condensed all the moisture they were able to contain, the unabsorbed moisture would collect on the tanks and drip therefrom on the floor, or be taken up by the atmosphere, and thus produce conditions absolutely ruinous to the eggs or other materials stored. And if the caloric given off exceeds the heat-absorbing power of the ice, there would be a corresponding rise in temperature, which would spoil the eggs. And there is absolutely no remedy for these things in the ice system, except through the enlargement or duplicating of the ice tanks. And, furthermore, without the extra appliances that would accomplish the drying of the atmosphere, the rooms cooled with ice must of necessity contain so much moisture as to mold and ruin all produce stored therein.

But in the mechanical refrigeration system all the extra heat—no matter how great—and all the extra moisture given out by the additional 1,000 cases, would be as easily absorbed as that given out of the first 1,000, and so long as the capacity of the machine was duly proportioned to the amount of work to be done, there would be no limit to the condensing power of the coils of the machine. For, as soon as the coils are sufficiently coated with frost, the refrigerating medium is shut off from one set of coils, and allowed to flow into another. As soon as the cold agent ceases to cool the pipes the frost liquefies and is conveyed immediately away, when they are ready to begin afresh their work of condensing the moisture out of the atmosphere.

We have taken many contracts to supply *dry* cold storage at any temperature, and the Hercules machine has not only never failed to perform its guarantee, but has so fulfilled the terms of the contract as to receive the warmest commendations from our patrons.

DRYING AIR IN COOLING ROOMS.

In an article by D. B. Beemer in the October number of ICE AND REFRIGERATION, he raises the question as to the comparative dryness as between rooms cooled by ice and by "artificial cold."

To this question I beg to say, that air can be dried either with ice or by mechanical refrigeratjon to the point of saturation at a given temperature, but this is the extreme limit possible by either method.

To make this clear, I would further remark, that a cubic foot of saturated air, at a temperature of, say, 100° Fahrenheit, holds in solution 19.84 grains of aqueous vapor. Cool this foot of air to 50°, and 15.74 grains of this vapor will be liberated. If cooled to 40°, 16.98 grains will be set free. If cooled to 30°, 17.87 grains, leaving only 1.97 grains in solution. This process holds good throughout all stages of temperature.

Drying the air is accomplished by separating this floating vapor from the air, and either removing or congealing it. Separation is effected either by bringing the air in contact with ice; with cold metallic surface (brine pipes, for instance); by passing it through several layers of fine mesh wire cloth, or by forced contact with water having a temperature below that of the cold air. A metallic surface having a constant temperature below freezing will congeal this moisture, and a light frost will form on the metal surface. If this surface has a variable temperature, both below and above freezing point, then the surface will be gradually coated with ice. In either case, when the air is once dried, there will be no further accumulation of frost or ice until fresh air has been introduced.

Air cooled by ice alone cannot be cooled below 32°, and at this point there would be little or no circulation over the ice, or over the metallic surface cooled by the ice. Moreover, every fluctuation of temperature would cause dripping from the pipes. With mechanical refrigeration, any desired temperature can be maintained in the rooms, with a constant temperature below freezing within the cooling pipes. This lower temperature of the pipes induces a circulation of the air, and, consequently, a more complete deposit of the floating moisture in the air.

From this recital of the process of air drying in cold storage rooms, it will be seen that air can be dried by ice within a limited range of temperature, but in no respect has it any advantage over mechanical refrigeration. Moreover, with mechanical refrigeration one may have perfect control of any temperature above zero of the Fahrenheit scale as dry as it is possible to get it, except by chemical absorption. J. K. KILBOURN.

RAILWAY REFRIGERATION NOTES.

——The Santa Fe Railway Co. is making preparations to develop the business of raising early vegetables in California for the Chicago market. It is expected soon to send from Los Angeles solid vegetable trains through on the same time as passenger trains. It is estimated that Chicago can consume and distribute 100 cars of vegetables daily.

——The California Dairymen's Union are making extensive preparations for supplying eastern trade with fancy, fresh butter and cheese this coming season. They anticipate large orders from that source during the winter months, say from January to May, when full-flavored grass goods are not obtainable in that part of the country. None but the choicest goods, that will stand long distance shipment, will be forwarded. An ash tub package will be used.

——A car of fresh fish from the Pacific was recently received at Toronto, chiefly halibut and salmon. The C. P. R. R. seems bent on giving a series of surprises. Certainly a dish of Pacific fish on Ontario tables will cause both astonishment and pleasure. It is one of the oddities of fact that as a rule the near one gets to the sea the worse is the supply of fish. Price rules everything salable, and there the higher prices obtainable at distant points bring better supplies than can be had in sight of the fishermen's boats. So it is in this case, in Toronto and other western cities the demand is so very large for halibut and salmon, that the British Columbia Fishing Co. has opened up a trade there, and talk of loading a car daily for the East.

——The St. Louis *Globe-Democrat* says: "The Mobile & Ohio Railroad Co. has put in service a line of improved ventilated refrigerator cars designed expressly for their service for transporting tropical fruits, strawberries and other delicate fruits and vegetables, also perishable merchandise of all descriptions. All the improvements are covered by patents. The car has ventilated end doors that may be partly ventilated or the insulated doors may be shifted clear of the openings, same as the side doors. The car may be loaded and given as much ventilation as required, and should there be an atmospheric change that would endanger the goods by frost, the doors may be sealed absolutely water tight, if necessary, without breaking the seals on the car. This is an important consideration that cannot be overlooked when goods are consigned from a hot to a cold climate, or vice versa, and at the same time it allows the shippers to regulate the temperature and ventilation to suit their own ideas."

TRADE CORRESPONDENCE.

[The publishers of ICE AND REFRIGERATION do not hold themselves responsible for the opinions expressed by correspondents on any topic; but these columns are at all times open for the discussion of subjects of interest to the trade. Our readers are cordially invited to contribute to this department by giving their views on questions propounded, or by suggesting original topics for trade discussion, or notes on the condition of trade in their section of the country. Anonymous letters will receive no attention whatever.—ED.]

FROM COLORADO SPRINGS.

To the Editor: At your suggestion in the last number of your excellent journal, I will try to give you a few points on trade from this point. There is one artificial ice plant, 20 tons capacity, in this place, which looks to me like a poor investment, where we have an abundance of fine, pure mountain ice; and the trade of this place does not need much over 2,000 tons a year.

The trade in natural ice this year has been light, and prices low, for two reasons. First, our railroads running into Texas agreed on freight rates to common points in Texas at $15 a car higher than last year, and made common points away this side of Fort Worth, Tex., which enabled St. Louis and the northern trade to have the advantage; second, most of the summer in Texas was remarkably cool, which shortened the season, as well as the trade.

Our storage capacity of ice houses is 15,000 tons; besides, we fill houses or load direct on cars in winter for the trade; and have the latest improved machinery for handling ice cheaply.

The ice trade in Denver and Pueblo is very much cut, and not much can be made at present prices.

Here is a question for your scientific readers: "Why does artificial ice freeze in globules, or like hail, while nature freezes ice in hexagonal forms from top to bottom, as will be seen when both are melted in the sun, or otherwise?"

CASCADE ICE CO.

FROM PORTLAND, OREGON.

Portland, Ore., is well supplied with ice factories, having three on the west side of the river and two on the east side; but at present only two are running. The plant at Second and Main streets still continues to turn out its fourteen tons and upward per day. The Boyle machine at Seventeenth and U streets is a "dandy." This machine was started up on February 1 last, and has made the continuous run of nine months without a five-minute stoppage or twenty-five cents for repairs, and is now running day and night. This plant was built for a 10-ton capacity, but after it fell into the hands of the P. A. Ice Co., with W. H. Harris as general manager and W. B. Bushnell, president, with assistance of W. E. Harris, the present mechanical engineer of the company, the plant has, ever since the change was made, turned out her 14¼ tons of beautiful, clear ice. This company has just finished putting in a cold room for storing ice, using in its cooling coils direct expansion from the ammonia condenser.

The two machines on the East side are idle, the demand for ice not being sufficient to warrant keeping them running.

W. B. Bushnell is now drawing plans for an immense factory at Spokane Falls, to be run with water power.

The Northwest Cold Storage and Ice Co. are doing well. Their rooms are well filled with fish and game, etc. Mr. McGuire, the superintendent, and W. P. Fought, the chief engineer, are gentlemanly good fellows, and their machinery is in good hands.

We all appreciate ICE AND REFRIGERATION, and snatch it greedily from the mail man when we see he has it in hand.

W. E. H.

MINOR LEGAL MATTERS.

——On November 12, the creditors of the Chester Ice Co. petitioned Judge Clayton to appoint a receiver to wind up its affairs.

——In the case of Dr. Malone *v.* the Knickerbocker Ice Co. —a suit brought at Milwaukee to collect a bill for surgical attendance upon an employe of the company—the jury disagreed November 3.

——The Richmond Ice Machine Co. is over with its financial troubles, and will resume business on a solid financial footing, a large amount of new stock having been paid for in cash, and the company re-organized.

——The Arctic Ice Machine Manufacturing Co., of Cleveland, Ohio, filed a cross-petition and counter-claim November 5, in the suit brought against them by the Forest City Ice Co. They ask for $30,000 pay for an ice machine made for the plaintiffs, which they refused to accept.

——James Nicholas, manager of the Knickerbocker Ice Co., of New York, was fatally shot by Policeman Barnes, October 30, while the latter was carelessly handling a pistol in the company's office in Thirteenth avenue. Nicholas was taken to St. Vincent's hospital and the policeman was arrested and when arraigned later was paroled in the custody of an officer to await the result of the inquest.

——The creditors of the Chattanooga Ice and Bottling Co. have agreed to an extension of time for the payment of unsecured creditors, and the company will at once resume business. The company is in good shape as to resources, and were only actually in temporary embarrassment, their real estate alone being estimated at $60,000 to $70,000, and entire debts only $69,000. The profits last year were $21,000.

——Judge Ingraham, New York, on October 30, granted an injunction restraining Fred W. Wolf, president of the New York Ice and Cold Storage Co. from removing the machinery from the concern's plant at 207 Fulton street, which has been supplying refrigerated air to Washington Market. The order was granted on application of A. E. Kein and E. C. Donnell, two of the stockholders. The receiver, Chas. S. Warner, is now in possession of the plant.

——The Mountain Ice and Cold Storage Co., of Salt Lake City, has brought suit against the city of Salt Lake and Watermaster Harvey, asking for a perpetual injunction to restrain the city from diverting a stream of water from the company's lands. The company has constructed reservoirs on their land, fed by the creek in question, from which they have for a long time cut their ice. The diversion of the water, the company claims, would injure and destroy their business.

—— Suit for $50,000 damages was begun in the Cook Co., Ill., circuit court by the Western Refrigerating Co., of Chicago, against the American Casualty Insurance and Casualty Co., of Baltimore. An interesting question will be raised at the trial. January 29 last, the building and contents of plaintiff at 231 Michigan street were entirely destroyed by fire. All the straight fire insurance was paid up, but plaintiff held a policy for $40,000 with the defendant company, which is disputed. It involves a construction of the wording of the policy and the terms of the risk. It is an accident policy, and a clause insures against loss or damage caused by accident. The question is whether that clause covers the loss by fire of plaintiff's property. The defendant does not deny the loss, but maintains that under the policy no recovery can be had.

——On November 19, Theo. Burkhard filed a bill in the circuit court at Chicago, asking for the appointment of a receiver for the Chicago Cold Storage Exchange, and to wind up the business of the company. Mr. Burkhard owns 449 shares of stock, and claims the company is insolvent. The petition was denied by the court, Judge Collins, on the ground that it appears that the company has been reorganized and is now in a position to pay all its debts, to finish the erection of its plant and to continue its business as originally designed. The company was organized with a capital stock of $3,000,000. E. G. W. Rietz was the president. Two sections of the proposed buildings have been erected, and alterations have been made in the old buildings at a cost of $500,000. The sections now in course of erection, and those already completed, will represent an outlay of $1,000,000. On account of these large expenditures the company has been pressed for money during the last month, and some time ago the larger creditors and stockholders attempted an entire reorganization for the purpose of placing the company on a satisfactory financial basis, so as to complete the buildings and plans. The reorganization has been accomplished, and George A. Moulton, president of the Pioneer Fireproof Const. Co., is at the head of the reorganized syndicate, and the affairs of the concern will go on without serious interruption. The capital stock is to be reduced from $3,000,000 to $1,000,000, half of which will be common and half preferred. The money is all pledged for the reorganization project, coming largely from persons heretofore outside of the company, but said to be among the strongest people in Chicago. The $1,000,000 of bonds which were authorized to be issued but were never sold will be canceled. The consent of all the old stockholders and others concerned to the reorganization has been secured. The company's affairs will hereafter be under the new management, and it is believed that the Cold Storage Exchange will be in a position to start in business with its new houses by the first of May. Two sections, constituting one big structure, are already nearly completed, and work on them will be pushed forward rapidly. There has been a contest among the stockholders as to the management of the business, but it appears that the stronger elements have triumphed.

——The Rockport Ice Co., Rockport, Me., during the last week of October loaded the schooner Oliver Pecker with ice for Demerara. She is the largest three-masted schooner on the coast, and a fine vessel in every way. She had arrived from Boston under command of Capt. A. J. Hall. Her lower hold was filled with ice and twenty-five tons of cabbage. After loading she towed to Portland, Me., where she took a general cargo between decks, and a deck load of sheep, and then sailed for Demerara.

——Owing to a demand made on the Knickerbocker Ice Co. of Chicago, by the owner of riparian rights at Fowler lake, Oconomowoc, Wis., for heavy royalties, that company, it is reported at Oconomowoc, has decided to abandon that ice field this winter and seek other territory. During the past two years the company has hauled about 6,000 cars of ice from Oconomowoc to Chicago, and after June 1 last, during the season, they hauled a train of ice to Chicago daily from this field. The company is looking up a site for houses at Oshkosh.

ICE AND REFRIGERATION

(ILLUSTRATED)

A Monthly Review of the Ice, Ice Making, Refrigerating, Cold Storage and Kindred Trades.

OFFICIAL ORGAN OF THE SOUTHERN ICE EXCHANGE, THE SOUTH-WEST ICE MANUFACTURERS ASSOCIATION AND THE TEXAS ICE MANUFACTURERS ASSOCIATION.

·.· DECEMBER, 1891 ·.·

SUBSCRIPTION PRICE, $2.00 PER ANNUM.

H. S. RICH & CO.
PUBLISHERS.

177 La Salle St., Cor. Monroe, CHICAGO.

206 Broadway, Cor. Fulton, NEW YORK.

Entered at the Chicago Post-office as second class mail matter.

Entered according to act of Congress, in the year 1891, by H. S. RICH & CO., in the Office of the Librarian of Congress, at Washington, D. C.

SOME GOOD WORDS.

Readers of ICE AND REFRIGERATION, who have lately taken pains to express in writing their appreciation of this journal will please accept this acknowledgment of their favor. Chief among such kindly greetings are the following:

[S. BAILEY, JR., Secretary and Treasurer UNION ICE MFG. CO., Pittsburgh.]

We are very much pleased with your journal. We wish you every success in the good work.

[CHARLES F. DUDLEY, Abington, Mass.]

Inclosed find $2 for subscription to ICE AND REFRIGERATION. Although a dealer in natural ice, I am very much interested in the manufacture of ice, and in refrigeration. I feel sure that your paper is, and will continue to be, a success. Consider me a life-long subscriber.

[P. MINOR, Phoenix, Arizona.]

Inclosed find $4 for two years, subscription to ICE AND REFRIGERATION. It is a long felt want in our business, and I am well pleased with it.

[GEORGE RETTIG & SON, HYGEIA ICE CO., Norfolk, Va.]

We think no one running an ice plant can afford to do business without your valuable paper.

[J. L. CLARK, M. E. Pittsburgh, Pa.]

Enter my name as a subscriber for ICE AND REFRIGERATION. I consider it one of the best journals published for the practical man, and its future will be the development of better results in engineering and factory practice.

[J. S. DOAK, Yoakum, Texas.]

Inclosed find subscription order. I have shown your ICE AND REFRIGERATION to several, and they all speak highly of it.

THE ROMANTIC TALE OF THE ICE MAN.

The ubiquitous reporter in a salt water town has told the tale of the ice wagon man, which, developed by the prolific pen of a Howells, might form the basis of an all-winter serial, but which, in the hands of the prosaic reporter is handed down to posterity as a cameo addendum to McAllister's "Society as I have Found It"—at the back door.

Charles, the ice wagon's treasurer, was poor; but "he loved," and love in some men develops an "Eli" temperament. He therefore cast his eye about him (figuratively speaking, of course), and having mastered the "2:30 list" of millionaires in that same salt water town, and the "tips" in the 12 o'clock editions, decided on breaking the record at a single dash by linking his fortunes with the frosty but "get-some" ice wagon; and having a "pull," he secured a gilt-edged route in a "swell" district, and proceeded to work it for all it was worth, until the end of the season, when the ice wagons should cease from rumbling and the driver counts his pelf. The Manitoba zephyrs, however, struck the swell district of Charles' route all too soon—just as, in fact, he had really trained down to the "get there" 2:30 gait of the ice delivery industry in a salt water town, and at the end of three weeks there was a killing frost, the snap collapsed and Charles went for to be a contractor on the rugged hills of the Green Mountain state. He was a true "Eli," however, and he knew a good thing when he saw it, even without a diagram, for it appears that on the magnificent salary of $12 per week he had managed to plant $160 in the "Spar" bank as the reward of his honest toil and commendable thrift.

In an evil hour, however, he met the "Serpent." For prior to leaving the salt water town, Charles turned over his bank book to the friend of his bosom (who was not the treasurer of an ice wagon, however), and hied himself to the wilds of Vermont, where he waited long and hard for the letter that never came with a remittance. Finally he humped himself back to that salt water town. He wanted to get married, and he needed that $160, for he had found that a 2:30 gait at amassing riches contracting on the bleak granite hills is less easily reached than by managing the finances of an ice wagon at the back doors of the granite palaces on an up-town avenue. But when he demanded the funds from the "Serpent," the latter refused to disgorge, and Charles was forced to hire a lawyer to bruise the "Serpent's" head.

Now, while Charles, as the financial man of an ice wagon, at $12 a week, needed no diagram to figure out a net profit of $160 in three weeks, it was necessary to at least explain the *modus operandi* when he undertook to squeeze the said net profits out of the belly of the Serpent on the trial before his honor the civil judge, for the Serpent defendant asserted that a part of the money in bank, which Charles claimed as his own, really belonged to the ice company. He had not turned it over to the ice company, but let that pass. The bruising of the Serpent's head, therefore, drew forth into the garish light of day some facts of interest to the student of the biology of the ice man, which *Puck*, from time to time, has delighted to picture for the edification of the unscientific but sympathetically interested "general reader."

When, therefore, the Serpent put the manager of the ice company on the witness stand to rebut Charles' statement, that the money belonged to him and that he had earned it while in the employ of the ice company, and the manager said that Charles had been in the employ of the company three weeks, the statement did not fall with a d-ll, s-ck-n-ng th-d, like the returns of the prohibition vote in the late election, but, rather, it flashed like the comet-tail of a Napoleon of finance, relating his experience. The balance of the "inquisition" was somewhat as follows:

"Is it usual for an ice wagon driver to earn $160 in three weeks at his business?"

Mr. Manager began to get uncomfortable, and to look around for a cake of ice to sit on. "I don't know," he said.

"Now, Mr. Manager, can you give the court an idea of how the defendant could have earned that sum in such a short time?"

The witness opened and shut his mouth, but said nothing.

"What are a driver's wages?" persisted the lawyer.

"Twelve dollars a week."

"That's pretty good work to save $160 out of such wages for that length of time, isn't it?"

No answer, save an appealing glance from the witness, who longed for a cave of gloom.

"Now, Mr. Manager, please explain how the plaintiff got so much money out of his business," went on the lawyer.

Thus adjured, the manager took a troche, and, seeing no escape for himself, reluctantly told his little story.

"The company," he said, "assigns a route to every driver, gives a certain amount of ice and a list of those to whom it is to be delivered. Appended to this list is the amount of cash he must turn over to the company. Here the company's concern ends. If the driver brings back the required amount of money no questions are asked."

"Ah!" said the lawyer. "Then if the driver doesn't deliver as much as he should to his regular customers the company doesn't care a snap?"

"No."

"And if he wants to sell a forty-pound chunk of ice for fifty pounds the company hasn't a word to say?"

"No."

"And if, after cheating all his regular customers, he sells the surplus ice to private customers of his own, and pockets the cash, still the company lets him do it?"

"Yes."

"Sort of a 'public-be-damned' arrangement, isn't it, Mr. Manager?"

No sound from the witness.

"That will do."

Judgment for $110, which was the $160 claimed, less $50 allowed the Serpent for expenses incurred in undertaking the business of pocketing Charles' money for a year and a day. Charles returned to the granite hills with his recovered money, and the marriage was solemnized without delay. The civil judge received a special invitation to attend the ceremony, and the public, who had paid the fiddler in advance, leaned up against the front fence and peered through the windows, while the band played "Annie Laurie." And that was the end of that.

MORAL.

When an ice company runs its business for the mutual benefit of the company and the driver of the delivery wagon, and the public is not in it, it ought not to complain if such methods and winking at the short weights of its drivers "do find it out" and give it a notoriety that no strictly honest man in the ice trade can feel is like unto a pearl of great price. The old saw, "Honesty is the best policy," is not founded on a very keen sense of true honesty, but "it goes" in business—even the ice business in a salt water town!

HARVEST FIELDS.

While ICE AND REFRIGERATION does not feel that nervous apprehension about the impurity of ice, which is the nightmare of some very good people, especially those sheep-like followers of the professional prophets of calamity, who are always hyper-critical, and their followers always more scared than hurt by every sort of new terror that forges to the front; nevertheless, there are certain elements of truth in the present war upon ice cut from polluted sources which the trade must bear in mind in order to avoid trouble in the future. Right or wrong, this question of purity has come to the front, and will stay there just so long as appearances favor the "calamity-ites."

The element of truth which lies at the bottom of the crusade against impure ice is the undeniable fact that ice, and still more than ice, drinking water, may be contaminated by the sewage of towns and cities when emptied into streams from points above which the supplies of potable water and ice are obtained.

The old theory that water polluted by sewage would purify itself in a running stream by contact with air, is, in a measure true, but only in a measure: as has been shown by the frequent analyses of Chicago river water (a mixture of sewage and lake water) pumped into the Illinois and Michigan canal, and thence conducted to the Desplaines at Joliet, and thence into the Illinois. The purification is very slow: and this is true of all streams so polluted. Commenting on analyses of Chicago river water, made at several times and places, Prof. Wm. P. Mason, of Rensselaer Polytechnic Institute, Troy, N. Y., (see *Journal of Franklin Institute*, November, 1891), says: "I have long been of the opinion that what may be very true for dilute sewage, does not hold good as we approach the limit of potable water. * * * My experience with the waters of large streams contaminated with city sewage, for instance, the Hudson river, is that self-purification is very slow." It is so true that the water of Illinois river at Ottawa, nearly 100 miles by river, from Chicago's sewers, not only discloses by analysis the impurities of the contaminating sewage, but shows these very impurities on the surface of the water itself; they also appear at Peoria, nearly as many miles further on. This is an extreme case, but it upsets the old theory. These impurities are even more potent when the streams are covered with ice, which prevents the purifying action of the atmosphere, the writer having encountered at "air holes" in the ice on Illinois river, sewage fumes as "fragrant" ninety miles from Chicago, as they were at the pumps at Bridgeport; while Dr. Craig, of Albany, N. Y., has said that at Van Wies' point, four miles below that city, the laborers cutting ice for the great ice houses had typhoid fever break out among them during January, having used river water for drinking purposes.

It is undoubtedly true, as shown by the Massachusetts Board of Health report on ice (ICE AND REFRIGERATION for August), that all the impurities of the water do not appear in the ice frozen from that water, except under certain conditions, as when water overflows the ice; and that, as Dr. Prudden says, "It is very few of the bacteria which can cause harm to man,"—except the typhoid fever: nevertheless ice frozen from such water may be more or less impure. And whether much or little matters not if once the public makes up its mind that it is impure even to a slight degree, and the dealer who cuts or handles it may be forced into a very unpleasant position, or suffer loss of trade by reason of such prejudice.

ICE AND REFRIGERATION, therefore, would advise all dealers to be even more careful than usual in their cutting fields. Many lucrative fields on such streams have already been abandoned, as at Peru, Ill., on Illinois river; at Rimmon pond, Naugatuck river, Connecticut, which used to send ice to Bridgeport, and others. To avoid "even the appearance of evil," is good counsel to accept at this juncture, when both theorists and practical scientists are sounding the cry of alarm.

"I FEEL like a cake of ice this morning," she is reported to say in *Harper's Bazar;* to which he replied: "That's good. Perhaps when the sun comes out you will be in a melting mood."

ANSWERS TO CORRESPONDENTS.

TO MEASURE THE QUANTITY OF ICE A COMPRESSOR WILL PRODUCE—BEST LUMBER FOR ICE HOUSES—BEST ICE PACKING MATERIAL—CRITICAL TEMPERATURE—MIXING BRINE SOLUTIONS—TO ASCERTAIN PRIMING—WEIGHT OF WATER AND AIR.

[This department of ICE AND REFRIGERATION will be conducted for the benefit of the trade generally, as well as individuals, and all competent inquiries will be given timely and proper attention, precedence in all cases being given to such questions as are of general rather than of individual interest.—ED.]

To the Editor: Will you kindly answer the following questions in ICE AND REFRIGERATION: How do you figure how much ice a given size compressor will produce, say a compressor 1-foot dia., 2-foot stroke, 70 revolutions per minute? Is it safe to figure it on a basis of 1 lb. of anhydrous ammonia equals 4 lbs. of ice, and 1 lb. of ammonia equals 21 cubic ft., or 5¼ cubic ft. of gas equals 1 lb. of ice? Do you allow any percentage for loss?

T. A. S.

ANSWER.—Supposing the above measurements to refer to a double-acting compressor (the number of revolutions is rather great), then

$$\frac{1^2 \times 3{,}145 \times 2 \times 140 \times 60}{4} = 13{,}200 \text{ cu. ft.}$$

of ammoniacal vapor can be taken into the compressor per hour: supposing, further, the pressure in vaporizer to be 55.2, then 5 cu. ft. of vapor are equal to 1 lb. of anhydrous ammonia: and as the latent heat of evaporation is 540 calories per pound of ammonia, the refrigeration produced is

$$\frac{13{,}200 \times 540}{5} = 1{,}425{,}600 \text{ calories.}$$

Add to this about 10 per cent contributed by the work of the compressor, which makes the total refrigeration 1,568,160 calories, which is equivalent to

$$\frac{1{,}568{,}160}{142} = 11{,}043 \text{ lbs. of ice.}$$

In other words, this is to say that the refrigeration that can be produced by such a machine is equivalent to the refrigeration that can be produced by so many pounds of ice being at the temperature of 32° F. The question as to how much ice can be produced by such a machine is a different one, depending on various circumstances, such as temperature of the water and of the ice produced, etc. Under certain circumstances it may not exceed one-half of the above so-called theoretical amount, in which case the actual ice producing capacity would not exceed some 6,000 lbs. per hour. So much as to the last question. From the above figures it does indeed appear (and this can also be shown in a different way) that the evaporation of 1 lb. of ammonia produces a refrigeration equivalent to that of about 4 lbs. of ice, and this is, we presume, what you meant by the closing remark of your inquiry. But of course in assuming this, a corresponding reduction has to be made when the actual production of ice is had in view.

To the Editor: Which is the best lumber to use in the construction of an ice house, white pine or yellow pine; and what material is best for covering ice in the ice house in summer, sawdust or hay?

J. J. H.

ANSWER.—For the building of an ice house, white pine would be preferable if the insulating capacity were the only point to be considered; but as it is more porous than yellow pine, and consequently more prone to absorb moisture, whereby its isolating power, as well as its durability, is greatly impaired, the yellow would probably prove to be preferable in the end. As regards the covering of ice, hay is preferable to sawdust, as its heat conducting power is less than that of sawdust.

To the Editor: We wish to commence soon packing 4,000 tons of ice, and would like to know the best way of doing it. Last winter we put away 4,800 tons, which adhered so that our loss in taking out last summer was almost one-third.

T. H. BRG. CO.

ANSWER.—The usual Hudson river method of packing away ice is to lay a solid stratum at the bottom; then pack above by leaving a space of two or three inches between the edges of the cakes, breaking joints every few strata or tiers, by allowing the cakes to lap over the joints below. The top layer is solid, like the bottom. The whole is surrounded (between the ice and the walls of the house) with sawdust, well packed as the tiers of ice are put into the house. With good non-conducting walls and ventilation over the top, ice so stored should come out in the summer with only the usual amount of shrinkage.

To the Editor: What is meant by the expression, "critical temperature" of a gas? Please state in your next issue, and oblige.

CH. S.

ANSWER.—Gases can be liquefied by applying to them a pressure sufficiently great at a temperature sufficiently low; for there is a temperature for every gas, above which it remains gaseous, no matter what the pressure is, and this temperature is what is called the "critical temperature," or "critical point."

To the Editor: Can you tell me what would be the effect of making a brine solution to stand a temperature of zero, using, say, one-half chloride of calcium, and one-half chloride of sodium? My reason for asking your opinion on this point is, that we have a large tank of calcium brine now in use at zero, and as we are to erect another tank of about the same capacity, I want to know what the effect will be if we fill the new tank with a salt solution, and then mix the contents of the two tanks. We do not want to throw away the solution we now have, nor do we want to use any more calcium if we can avoid it, and the contents of the two tanks must be mixed indefinitely. J. C. M.

ANSWER.—We see no objection to the mixing of solutions of common salt and chloride of calcium for refrigerating purposes, provided both are pure, or practically so. If they were not, if, for instance, the solution of salt contained sulphate of soda, on mixing, a precipitate of sulphate of lime would be formed which might clog the pipes. Thus, as a precautionary measure, it would be advisable to mix the clear solution of both materials in a transparent vessel (glass bottle) and observing whether the mixed solution remains clear for some time. If it does not, it would hardly be advisable to mix the solutions as you intimate, unless you can mix them so as to allow the precipitate to settle and to be eliminated before you introduce the solution into your pipe system.

To the Editor: We are aware that in a steam boiler more or less water is carried over with the steam, causing what is commonly called "priming." Is there any simple method by which the amount of priming can be determined? TH. H.

ANSWER.—We know of no very simple way to do this. It may be ascertained by a calorimetric contrivance, by which the amount of heat imparted to a certain amount of water by means of a given amount of steam withdrawn from boiler under a certain pressure, is measured. Since the difference between the heating power of a certain amount of live steam at the observed pressure and that of water discharged from boiler under that pressure, can

be readily ascertained, the percentage of priming can be calculated from these facts and the above observations.

To the Editor: Please give us in your next issue the weight of a cubic foot of water and the weight of a cubic foot of atmospherical air. F. W. T.

ANSWER.—The weight of a cubic foot of water is 62.3 pounds; that of a cubic foot of air, 0.081 pound.

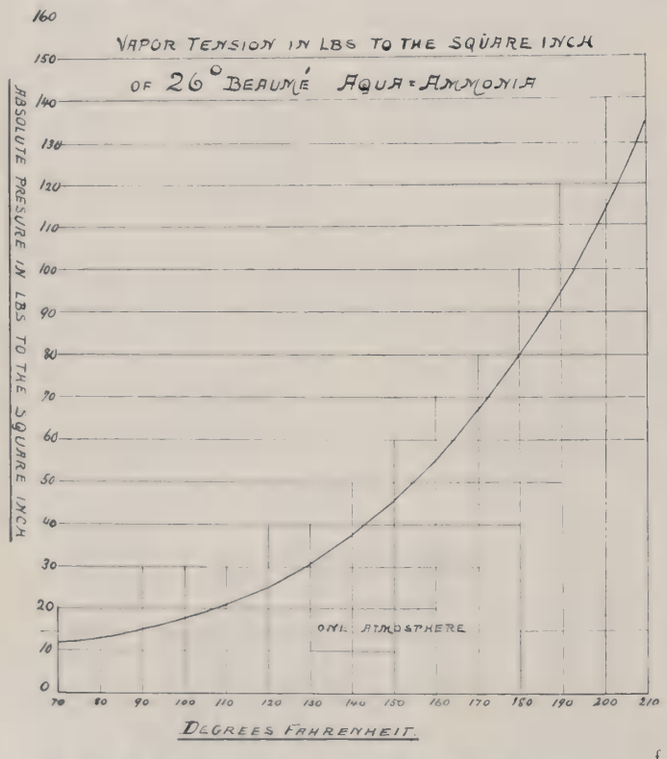
[*Written for* ICE AND REFRIGERATION.]

PRESSURE OF AMMONIA GAS.

AN ANSWER TO A QUERY AS TO PRESSURE OF AMMONIA GAS IN A RETORT UNDER CERTAIN CONDITIONS, IN ABSORPTION AND COMPRESSION MACHINES.

BY H. JOHN KREBS, M. E.

To the question propounded by your correspondent—"We would like some expert to tell us what pressure we can get on a retort that is one-tenth full of aqua ammonia (26° B.), provided it is at a temperature of 200° F."—I would say that the pressure in a vessel (the vapor tension) is not affected by the amount of liquid in the same, provided space remains for the gas. In a vessel, however, filled brim full, and, after being closed, heated up, a pressure will arise from the expansion of the liquid much in excess of the vapor tension corresponding to the temperature.



At 200° F. (26° B.) aqua ammonia has a pressure of just about 100 pounds per square inch above the atmosphere, as you will see from the accompanying arched pressure curve, which, probably, will interest others, as I know of none such published.

This pressure curve is sufficiently accurate for practical purposes, as the instruments at my disposal in determining the same were fairly accurate, though not sufficiently so for scientific *data*. The boiling point of 26° B. aqua ammonia, at atmospheric pressure, is, as will be seen, about 87° F.

Your correspondent further writes: "The point I wish to know is, what the temperature of the gas is when it enters the pipe leading to the condenser."

To this I would say that the gases from absorption machines generally enter the condenser at a much lower temperature than do the gases from the compression machines, even when both are working under the same condensing pressure. The reason for this is that the cooling of the gases, produced in the generator, previous to their arrival at the condenser proper, is recognized as the handiest process for condensing the moisture, that is, drying the gas; and, therefore, the temperature of the gas on leaving the generator, or rather, the dephlegmator, or rectificator, vessels fitted to same, should be but very little in excess of the temperature of pure anhydrous ammonia corresponding to the pressure carried.

Thus at 150 pounds pressure above the atmosphere, the gas entering the condenser pipe should be but little above 84° F.; at 160 pounds pressure, but little above 87° F.; at 170 pounds pressure, but little above 91° F.; at 180 pounds pressure, but little above 94° F. The pressure, I need not say, depends, in the first instance, on the temperature and abundance of the condenser water.

In compression plants the case is different. The gas from the pumps is heated up through the compression generally to above 212° F., and as it is dry there is no necessity for cooling the same previous to its arrival at the condenser, where it frequently arrives at about the temperature named. This, as explained, should never be the case in absorption machines, though sometimes sections of the condenser are used as dephlegmators, in which case they must not be confounded with the condenser proper.

FOREIGN ITEMS.

Ice plants are being introduced rapidly into Mexico, and the "Hercules Iron Works" is about to ship a small ice-machine to Culican.

——At the recent London "Dairy Show," Tiddeley & Co., Ltd., of Liverpool, were awarded a silver medal for an arrangement for the artificial cooling of dairy products.

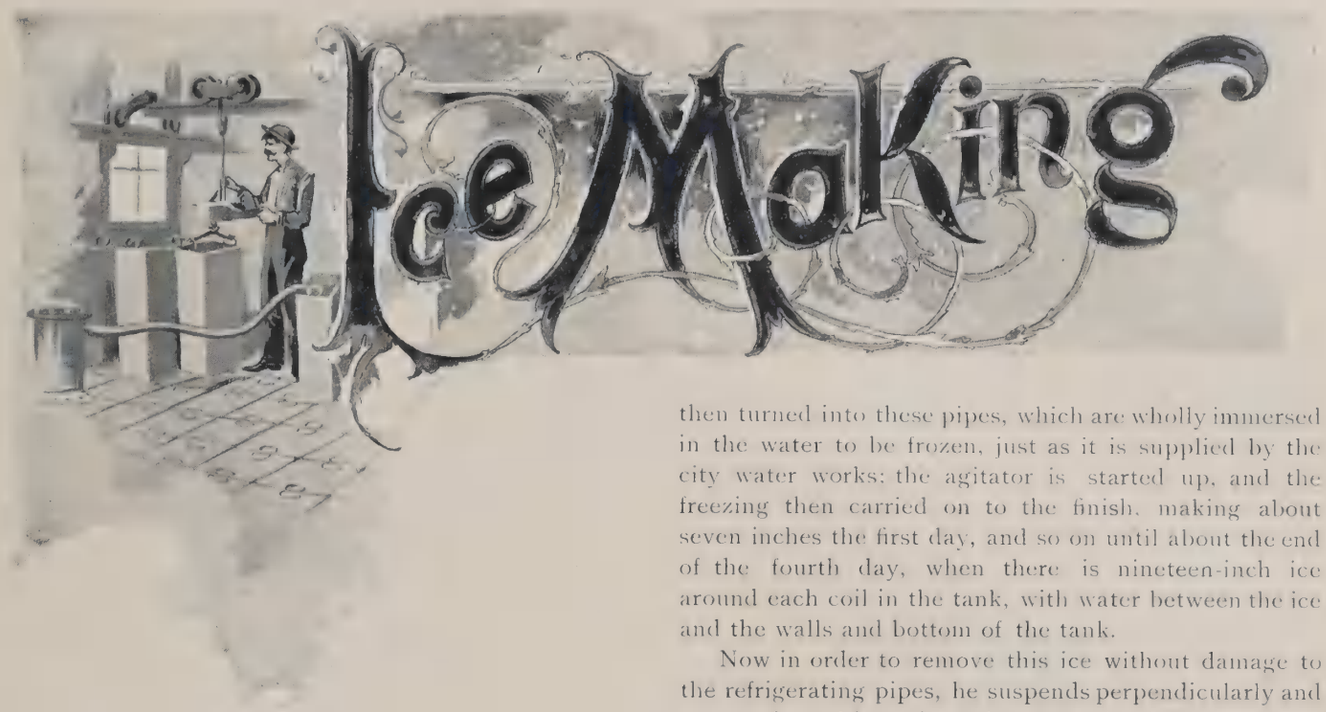
——The Belgian consul-general at Melbourne, Victoria, Australia, says that, "The Victorian minister of agriculture has opened a competition for the invention of some economical method of refrigerating a chamber destined for the preservation in summer of milk, butter and cream. Prizes to the value of £300 will be awarded."

——M. Auguste Pellerin has just erected in London, at a cost of £40,000, a factory for the manufacture of "Le Dansk" margarine, a new butter substitute, made from oleomargarine, fine fresh butter and milk, 2,000 gallons of milk being used daily. The plant is refrigerated by a large machine specially designed for this plant by a firm in Paris, France, who built and installed the refrigerating plant at these works.

——A German official report from Havana, Cuba, says: "The ice making machinery hitherto in use here has been worked upon the ammonia system; the apparatus, which was of German origin, having found a very favorable reception. French machinery of a similar nature also sells fairly well, but the preference is given to the German machine. A German factory has recently attempted to fix up a machine for making ice by means of carbonic acid. No success was obtained, however, as the temperature of the water used in the process could not be reduced beyond 25."

——A new steamship line has been established between England and Burmah by the Bibby Steamship Co., Ltd., of Liverpool, with special facilities for carrying all species of freight, as well as passengers. The following are the steamers which now comprise the new fleet: The Lancashire and Yorkshire, each of 4,200 tons register and 3,500 effective horse power; the Cheshire and the Shropshire, each of 5,730 tons register and 4,000 effective horse power. All the steamers are supplied with cold air refrigerating engines and chambers, which will insure throughout the voyage plenty of fresh provisions of all sorts, and an abundant supply of fresh ice, as well as cold air for the ventilation of the hold when necessary for the proper care of the cargo.

——The Abita Springs Ice Co., New Orleans, during the winter will bottle the Abita spring water, from which they make ice, to be sold to their summer ice customers.



[*Written for* ICE AND REFRIGERATION.]

A NOVEL ICE MAKING PLANT.

ICE MAKING IN THE FAR WEST—SYSTEM OF S. D. LOUNT, INVENTOR AND ICE MANUFACTURER OF PHŒNIX, ARIZ.—FREEZING UNDISTILLED WATER—A UNIQUE COMPRESSOR PUMP.

Mr. S. D. Lount, ice manufacturer, of Phœnix, Ariz., is at present in the city of Chicago, superintending the construction of the machinery for the enlargement of his plant at Phœnix, a beautiful town in the heart of the famous Salt river valley, which, in the past few years, man, by his irrigating canals, has converted from a veritable desert to a "paradise of the gods."

Mr. Lount's machinery, except the engine, which will be one of the Corliss type, is so novel and unique that a description of it will undoubtedly be of interest to readers of ICE AND REFRIGERATION, as we know of no other ice making plant of this type in the country. The entire system, including the ammonia vapor compressor, is the invention of Mr. Lount, his letters patent being (for manufacture of ice) No. 259,697 (June 20, 1882) and (for pump) No. 251,373 (December 27, 1881). Mr. Lount makes clear ice from an undistilled water, which carries a great deal of mineral, as does most of the water in that territory, by direct expansion, without brine, the system being substantially the following:

The freezing tank is an oblong box (inclosed in a building with non-conducting walls) usually covered with boards, removable in sections when the ice is to be removed. In this tank he places one or more rows of flat coils of pipe, held in an upright position in the water to be frozen, and supported by posts in such manner that the blocks of ice formed in the congealer, except at one end of the tank, do not touch any solid substance. In this tank also he has placed an agitator, below the congealer and the blocks of ice when formed. There is also at each end a low partition, forming receptacles, or eddies, for catching the solid impurities suspended in the water to be frozen. The ammonia is then turned into these pipes, which are wholly immersed in the water to be frozen, just as it is supplied by the city water works; the agitator is started up, and the freezing then carried on to the finish, making about seven inches the first day, and so on until about the end of the fourth day, when there is nineteen-inch ice around each coil in the tank, with water between the ice and the walls and bottom of the tank.

Now in order to remove this ice without damage to the refrigerating pipes, he suspends perpendicularly and across the refrigerating pipes a series of sheet-metal tubes, closed at one end, hanging by hooks to bars above the congealer, these tubes, on one side, being placed in contact with the coils or rows of the congealer, or refrigerating pipes. When the ice is ready to be removed the block is first divided crosswise from top to bottom at the posts supporting the coils, which are beveled from where the congealer pipes pass through them to their center—a division which can be made with a saw or by one of the sheet-metal tubes suspended in touch with the post and a wedge. This division made, the sheet metal tubes are loosened from the ice by filling them with water at a temperature above freezing by a hose connected with the water tank. Long wedges are then inserted in the holes left by the tubes, and a few blows split off the section of ice from the main block, and there is room at the free ends of the block at the end of the tank to lift them out. The remaining sections may be taken out in the same way, the last, or third, section readily breaking off where it is frozen to the end of the tank when the wedges are driven. For removing the ice from the other side of the coil, which is clinched between the congealer pipes, a wedge or two is easily driven through the ice next to the line of pipes, when the clinchers break loose without much waste.

In practice there are several coils of pipe (one inch is the best size to use) in one congealer, all in the same tank, the ends of these coils being connected with three-way cocks placed outside the tank, so that one or more of the coils can be instantly thrown out of the circuit, while the refrigerant flows through the others. In this way ice can be removed from one coil without interfering with the freezing at the other coils, and when the ice is removed more water is turned into the tank to take its place, and the circuit of the coil being resumed, freezing recommences at the cleared coil again, so that the making and removal of ice is a continuous process.

The clearing of the ice in freezing is effected by the agitator. Rapid freezing in still water causes the ice to be white and porous, but if the freezing ice is in contact with water in motion the minute air bubbles are liberated and cannot cling to the surface of the ice, which

consequently freezes solid and clear—all that is necessary to make clear ice being to prevent the air bubbles from adhering to the ice in one place long enough for a film of water to freeze over them, thus fastening them in the ice. The agitator in this tank, as said before, is placed below the congealers and the ice formed upon them, so that it never clogs, and is simply made of revolving blades attached to a perpendicular shaft.

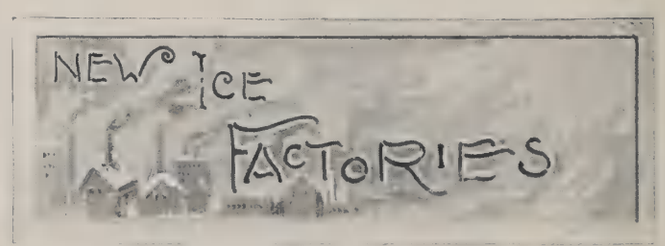
Mr. Lount does not claim that this idea of forming ice in a tank of water, by immersing naked pipes containing the refrigerant, is entirely new with him; but he does claim that the details of its construction, whereby the agitator always remains in uninterrupted action, and also a practical method for removing the ice so formed on the coils, is. In practice, it has been eminently successful at his plant, where he is daily making perfectly clear, solid ice, from undistilled water at a cost which is very considerably under any yet reported to ICE AND REFRIGERATION from other sources. Many more details of construction might be given, but the above, we think, clearly describes the process.

THE COMPRESSION PUMP.

The compressing pump used by Mr. Lount is also of his own invention, and is very simple. It consists of a cup-shaped piston with a reservoir for containing the lubricant, so constructed within a cylinder that all parts subject to friction are lubricated from the reservoir, while the lubricant itself is not allowed access to the compression chamber or heated vapor.

The upper surface of the valve at the head of the piston is turned to fit the end of the cylinder, so that the piston may be adjusted by means of a screw thread at the lower end of the piston rod to force all the vapor between the valves through the upper valve at the end of its stroke, access to both valves being had by removing the cylinder valve cap and the cylinder head, the outlet pipe from the cylinder head, of a few feet long, having spring enough to allow of the head being lifted from the cylinder and placed to one side. The lower end of the cup-shaped piston is provided with a tight packing ring. When the piston is moved upward the vapor to be compressed is drawn from the inlet pipe through pipes or channels into the cup of the piston, these pipes extending through and above the lubricant in the reservoir within the cup; and thence into the compression chamber at the downward stroke, where it is compressed by the following stroke and forced through the cylinder valve into the outlet pipe. The heat developed by compression is all in the upper end of the cylinder, and, of course, the upper and closed end of the piston at each stroke passes through this heated chamber; but as the packing ring is separated from this closed end by the thin wall of the piston, it cannot become heated, for the reason that the interior of the piston is always in contact with uncompressed, and, therefore, cool vapor, which takes up from this thin wall of the cup such heat as the metal conducts from the compression chamber and the ring encounters at the lower end of that chamber, and at the downward stroke the vapor is transferred to the compression chamber. Furthermore, when the pump is under heavy pressure, the piston should be made longer than its stroke, so that the packing ring shall never travel over any part of the cylinder that has been in contact with the heated vapor, except that minute portion which is forced around the piston above the packing ring. Bearing this in mind, and remembering that the inlet pipes for the uncompressed (cool) vapor extend upward into the cup through the lubricant in the reservoir, it is readily seen that neither the packing ring, the cup of the piston nor the lubricant can become heated. Besides, with the reservoir kept full, or partly full, of the lubricant, the piston rod, as well as the lower end of the piston and the packing ring also, at each stroke, pass through the lubricant, which is cooled by contact with the cool vapor from the inlet. This pump or compressor, therefore, requires no water jacket, nor the application of any cooling medium except the vapor passing through the pump and compressed by it, while the lubricant employed cannot fail to be applied in abundance to every working part. In practice such a pump has been in constant operation for eight months, compressing ammonia vapor to a tension of 120 to 180 pounds per square inch continuously without having the piston half of the cylinder heat up above blood heat, while the compressor half stood at a temperature above that of boiling water, and at the end of eight years of such service neither the piston, the piston rod, nor the interior of the cylinder showed any perceptible wear.

The pump is as simple in construction as a common water pump, and not much, if any, more expensive, while it is so economical in working with ammonia that one wonders how it happens that it has been permitted to lie buried in the orange and fig groves of Phœnix all these years. Some wide-awake manufacturer of compressors ought to bring it out of Mr. Lount's paradise of Phœnix, and give it a chance in the world.



There is a steady, and, we may say, healthy growth, in the main, of the ice making industry throughout the country. It may not at the present seem to be of any great moment; but the seeming light increase of factories projected is in a measure due to the season, but more to the absence of "craze" on the subject. This is always a healthly sign, since with buyers in a conservative mood only such plants will be put in as, after thorough investigation, promise a profit; and existing plants are less often duplicated, with disaster to both new and old establishments. The record of new plants, enlargements, etc., for the month is as follows:

ARKANSAS.

Fort Smith—The Border City Ice and Coal Co. have begun the erection of a new building, 23×90 feet, to contain new machinery for enlargement of the plant. Mr. W. O. Caldwell was east in November to buy the machinery.

FLORIDA.

Inverness—The new ice factory has begun operations, the first cake, with flowers frozen in the center, having been put on exhibition at the hotel, October 29.

GEORGIA.

Augusta—The Augusta Ice Co. will increase capacity by 10 tons daily.

Carrollton—Atlanta parties are talking of establishing an ice factory.

Fort Valley—A 10-ton ice factory will be erected by H. C. Harris and others.

ILLINOIS.

Chicago—The Pure Ice Manufacturing Co., of Chicago, has been licensed to incorporate; object, to manufacture ice; capital stock, $200,000; incorporators, J. M. Evans, L. E. Evans and R. L. Tatham.

INDIANA.

Richmond—The Gresham Ice Co. has been organized by J. W. Gresham, A. W. Bliss and James M. Race, to manufacture ice; capital, $16,000.

LOUISIANA.

Donaldsonville—The Donaldsonville Ice Co. has been organized legally, all stock, $30,000, being taken. Work has begun preparing the site for the plant.

New Orleans—The Salmen Manufacturing Co. has been incorporated; capital, $200,000; will manufacture ice, etc.

NEW JERSEY.

Newark—The Krueger Ice Co. are doubling the capacity of their plant, which will give the works capacity of 240 tons.

Paterson—The Diamond Ice Co. will enlarge its capacity from seventy-five to 100 tons for next season, the capital stock being increased to $100,000. The Diamond company has purchased the plant of the Artesian Well Ice Co., and both plants will be removed to new buildings, which will be erected at once.

OHIO.

Dayton—The Soldiers' Home has recently completed the erection of an ice plant and cold storage system. The improvement, in its entirety, has been designed and constructed by Messrs. W. P. Callahan & Co., of Dayton.

TENNESSEE.

Johnson City—Work on the building for the new ice factory is nearly completed. It is a fireproof structure.

TEXAS.

Taylor—The Taylor ice factory shut down November 1 for the season. During the winter all the present machinery will be removed, and an entirely different outfit substituted for it.

Paris—The Arctic Ice Co., of Paris, Tex., has entered the field for the manufacture of pure ice, and has given an order for a "Hercules" to be put in working operation in a short space of time.

VIRGINIA.

Norfolk—The Tidewater Ice Co. has been organized by H. B. Nichols (president), W. A. Wrenn (secretary) and others; capital, $150,000.

Norfolk—The Nottingham & Wren Co. has been incorporated; T. J. Nottingham, president, and G. B. Ferber, secretary; capital, $40,000 to $100,000; will manufacture ice, etc.

WASHINGTON.

Olympia—The Bay View Brewing Co., of Seattle, are erecting a 10-ton ice plant.

Spokane—Is to have an ice factory and cold storage plant, with 50-ton machine.

THE FIRE RECORD.

——An ice house was burned at Arcola, Ind., October 30.

——The ice houses at Muncie, Ind., have all been burned by incendiaries.

——The Alton, Ill., Ice Co.'s house was slightly damaged by fire, October 26.

——Jacob Gehring's ice houses, etc., at De Pue, Ill., were burned November 3.

——The Munroe ice houses at Bloomington, Ill., were burned November 4.

——The ice houses of Burnham & Co., Brownfield, Me., were burned November 4; loss, $2,500; insured.

——Thomas Jones & Son's empty ice house at Neenah, Wis., was burned November 1; loss, $600; no insurance.

——The entire plant of the Dallas (Tex.) Dressed Beef and Packing Co. was burned November 24; loss, $200,000; insured for $51,000.

——Three large ice houses on Genesee street, Buffalo, N. Y., owned by Sullivan & Nunan, were burned October 28; loss, $50,000; insured.

——On October 31, a storage house belonging to the Greenville (Tex.) Ice Co., was burned, together with its contents of bottled beer; loss, $2,500; insured for $1,000.

——The Bull's Eye Bridge Ice Co., Bangor, Me., lost an empty house November 18, which was blown down in a wind storm. Another house also was injured in the storm.

——Burnham & Co.'s ice houses at Mt. Cutler pond, Brownfield township, near Bangor, Me., were burned, and 3,000 tons of ice destroyed; loss, $4,000; insurance, $2,700; cause unknown.

——The Burton Dickerman ice houses, near New Haven, Conn., were burned November 15; loss, $12,000; loss of ice, 5,000 tons, valued at $4,000; insurance on building, $4,000; cause, supposed to be fired by tramps.

——The stable of the Cincinnati Ice Co. was burned November 6, and twenty-eight valuable horses perished in the fire. Three wagons and a large stock of feed were also burned. The loss exceeds $6,000; insurance, $1,000; cause, supposed, locomotive sparks.

THE NATURAL ICE TRADE.

All interest in natural ice now centers on the outlook for the new crop to be made during the coming three months. At this writing, November 17, in the West at least, the prospect of freezing weather for making a crop is "quite flattering," the Northwest experiencing the first taste of zero weather brought in suddenly by a Manitoba zephyr of the typical sort. Ice formed in all the northwestern states.

One source of anxiety exists, however; and that is the scarcity of water at most of the river cutting fields, the fall having been unusually dry. This difficulty is not by any means confined to the West, but extends over the whole country. A telegram of November 7, from Portland, Me., says:

"Maine's usually great ice crop is seriously threatened this year by drought. For months the water supply has been gradually failing, and now the small rivers are nearly dry and the larger ones are lower than for years. The ice men are feeling very much discouraged, and unless heavy and prolonged rains come before winter sets in, the crop will be a failure. At Augusta, a person can easily wade across the Kennebec, and the Androscoggin is practically without water. The great mills at Lewiston would be shut down were it not for the fact that the lakes have been tapped by canals. But this has continued so long that the lakes are several feet lower than for years, and this will ruin the lake ice crop. The Penobscot is so low that the current is not powerful enough to keep back the tides, and the water is consequently so salt that the ice would be unfit for use."

This statement, which, in the main, is no doubt correct, is made the text for an onslaught by the daily press of New York, "me-too"-ed by all the smaller newspapers of the East, on the "ice magnates" as "calamity howlers"—for a purpose; but the fact remains that there is some reasonable apprehension of difficulty ahead, should the drought continue.

Meantime, however, in all parts of the Maine ice field, active preparations are making for harvesting the crop when it comes. Old houses are being repaired, and many new ones are in course of erection. Along the Kennebec there is little ice to be carried over, and only one house that has gone through the season untouched. The demand from Philadelphia and to the southward has been increasing year by year, and even should there be an ordinary supply south of Maine, the shippers believe that the regular demand for Maine ice will call for all that can be cut and housed with the present plants. In the event of a warm winter and ice shortage on the Hudson, the Maine dealers would be well situated to make money, and they are making all preparation to handle the trade and meet all requirements. On the Penobscot, the same activity is seen.

Apropos of the ice business in Maine, the Bangor *News* of recent date says:

"About one-half of the residents of Bangor remember when the ice houses on the Penobscot river were very few and very small. All the big arks of houses that now wall in the river on both sides, as if they were fortifications, have been built within the past twenty years. Prior to that date ice formed in the river year after year, and all the use that was made of it was for a skating rink for the boys and girls, or a bridge to dodge the exaction of the ferry men and toll gatherers. Now a river

frontage is considered good property, and the ice crops have begun to be looked upon as one of the chief harvests in Maine.

"Up to within a very few years it was supposed that Hudson river ice was the making or marring of all other fields. If there was a good crop on the Hudson, ice men in other places had no show, and if the Hudson river harvest was small, then the Penobscot and Kennebec ice men could lay plans for good profits. Now these things are changed. Hudson river is not big enough to regulate the price of ice, and even if it were, the ice made in Maine is thicker and of better quality, thus making it more desirable to ship to southern ports.

"In a few years more, if the rate of increase keeps on, not only will all the big rivers of Maine be uncovered every winter, but the adjacent ponds and lakes that are located inland, will be utilized and made to yield their annual dividends to their owners. The very nature of things says this will be so. The private residences in all the cities and villages are now using ice constantly, where but few took any ten years ago. Add to these the markets, the storehouses, the hotels and restaurants, and the thousands of other places where ice is constantly employed, and the consumption is now enormous. Just now Secretary Gilbert, of the Maine board of agriculture, assisted by able dairymen, is going over the state, talking to the farmers and advising them to start creameries. What Mr. Gilbert is doing in Maine other men are performing all over the northern states. Even this change from the old style of raising the cream to the improved methods will require hundreds of thousands of tons of ice annually. Much of it will be cut by the farmers, to be sure, but all will help develop the use of ice and more ice. In a short time, the danger will be that the ice will be cut so closely that the boys will have no place upon which to skate."

ICE TRADE NOTES.

——C. Day is building an ice house at Walton, Iowa.

——Isaac Crisman has gone into the ice business at Victor, Iowa.

——Joseph Harris is erecting a large ice house at Lonaconing, Md.

——The Maple Park Ice Co., Carroll, Iowa, will erect a large ice house.

——Jos. Hægelin has built a new ice house at his brewery, Atchison, Kan.

——The U. P. R. R. ice houses at Salt Lake City are nearly completed.

——The Essex Ice Co., Reno, Nev., is clearing the ice pond for the winter cut.

——The Park City (Utah) Ice Co. are finishing an ice house to hold 5,000 tons.

——A. J. Love has commenced building a large new ice house at Grayling, Mich.

——A Lowell, Mass., ice company will fill two buildings the coming winter at Forge Village, Mass.

——Mr. J. M. Fletcher has put in the foundation of an ice house at the Harbor Pond, Nashua, N. H.

——W. A. Bean & Co., Concord, N. H., have sold out to the Concord Ice Co., John E. Robertson, manager.

——Hastings & Co.'s new ice house at Troy, N. Y., has been completed. It has a capacity of 1,500 tons.

——Deichert & Day, Nethart, Mont., have completed their dam and are at work putting up a large ice house.

——The Meadow Cove Ice Co., at Pemaquid, Me., are making preparations for an extensive cut this winter.

——The South Grand Rapids Ice and Coal Co., at Grand Rapids, Mich., has been incorporated: capital, $25,000.

——The Anderson & Freeman Ice Co., Springfield, Ill., has increased the number of its directors from four to five.

——Some of the dealers at Harrisburg, Pa., have a quantity of last year's supply left over for next year's consumption.

——Daul. M. Long & Son have built another ice house at Fayetteville, near Chambersburg, Pa., on the C. & G. R. R.

——The Ice Co. at Port Byron, Ill., are making extensive improvements at the chutes and runways, to facilitate harvesting.

——The Knickerbocker Ice Co., of Cleveland, will establish a warehouse with a capacity of 50,000 tons at Harbor Springs, Mich.

——The People's Ice Co., Erie, Pa., has broken ground for the erection of another big ice house in the vicinity of the Pittsburg docks.

——The ice business at Sioux City, Iowa, has closed for the season, and nearly all the dealers report a considerable stock left on hand.

——Heller & Sons are making large additions to their houses at Sioux City. The packers, also, are getting ready for the ice harvest there.

——The Pawtucket, R. I., Ice Co. is building a new ice house, and will lay a branch track to the house from the N. Y. & N. E. railroad.

——The Drivers' Union Ice Co.'s houses at Chebacco pond, Gloucester, Mass., are being repaired for the winter cut. The houses are now empty.

——Joseph Eidenberger, ice contractor, of Port Washington, Wis., will build a new ice house at Saukville, which will be larger than the old one.

——W. R. Gilmore, West Rutland, Vt., has enlarged his ice pond to twice its former capacity, and is about to erect a storage house near by.

——The Detweiler Ice Co. has been licensed to incorporate; capital, $33,000; incorporators, Henry Detweiler, T. H. Detweiler and W. H. Detweiler.

——At Thwing's Point, near Bath, Me., the old buildings which it was once thought would be destroyed, are being repaired and a new house built.

——The Orrington, Me., Ice Co. finished the season's shipments about the 15th ult. The New York Ice Co. at that date was still shipping from the same place.

——The Echo Lake Ice Co., Booth Bay Harbor, Me., have repaired their dam, and are putting their houses in shape for the winter. The stock has all been shipped.

——The city of Oshkosh is very much interested in the proposed removal of the Knickerbocker Ice Co. houses from Oconomowoc to that city; and the citizens hope to induce others to build houses there.

——The Great Falls Ice Co., at South Gardiner, Me., had, November 1, shipped all but about 12,000 tons. Four vessels arrived that day to take away 4,000 tons, which will reduce the amount to 8,000, which they will carry over.

——At Brookline, N. H., the first of the new ice houses has been raised, the dimensions being 135 by 240 feet, and 30 feet post, with a capacity of 20,000 tons. The ground is cleared for the other houses, and the grading done.

——The Loon Lake Ice Co. has been organized at Spokane, Wash., by E. J. Bower, formerly of the Crystal Ice Co., and Lee A. Hill, also late of the same company. They will build at Loon lake an ice house of 6,000 to 7,000 tons capacity.

——H. A. Orth, superintendent of J. S. Sible's ice business at Harrisburg, Pa., for the past sixteen years, has accepted the position of superintendent of Lake Conewago Ice Co., of Mt. Gretna Park, and will establish headquarters at Harrisburg.

——The National Ice Co., Reno, Nev., has completed a second ice house of large size, and a second dam is now being built across the Truckee, which when completed will give the company two ponds on the river and one up the canyon, from which the company expects to harvest 18,000 tons of ice, under the direction of Superintendent Simonds.

——The following officers of the People's Ice Co., Rochester, N. Y., have been elected: President, Charles Watson; vice-president, Camille Forest; secretary and treasurer, Leo Schlitzer; board of directors, Charles Watson, Charles Kimpal, M. A. Zimmerman, W. W. Barnard, Camille Forest, John J. Karle, Charles L. Horn, Leo Schlitzer, George J. Oaks.

Operators of ice making and refrigerating plants are referred to the advertisement of the Nubian Iron Enamel Co., whose specialty is "Nubian" black iron enamel for machinery. Their line of goods covers the entire field, from the commonest to the very highest quality of blacks; and, from the first, Mr. Bonnell has made a specialty of blacks for refrigerating plants, and, in Chicago, supplies nine-tenths of all this class of machinery, as well as the largest makers of such machinery. Though the "Nubian" is sold for much less than other makes of blacks, years of trial have proved its high character; which is further attested by the 1889 and 1890 medals of superiority from the American Institute, N.Y.—the highest award for this class of goods. Circulars and testimonials sent on application.

[*Written for* ICE AND REFRIGERATION.]

THE ICE MACHINE OF THE FUTURE.

FOUNDATION PRINCIPLES OF THE REFRIGERATING AND ICE MAKING MACHINE—FUTURE IMPROVEMENT TO BE MADE ON SCIENTIFIC LINES, NOT BY A FLIGHT OF GENIUS.

BY STUART ST. CLAIR.



THOSE who are engaged in the manufacture of ice machinery are often confronted with startling news and statements regarding certain machines offered, or about to be offered, the public, that are going to revolutionize the entire business—produce ice for a fraction of the present cost, and be absolutely automatic in action. Now, as many of your readers are purchasers of refrigerating and ice making machinery, and are naturally interested, the writer has thought that it would not be amiss to treat this subject in a general way, dictated by a mechanical experience of years.

There is one fundamental law we cannot possibly ignore, which has been reduced to a homely but true saying, "We cannot produce something from nothing." Every *effect* has a *cause;* and each force employed a cost in energy in some form. Air, water or other matter has its specific heat, which cannot be removed without a *cost* of energy. *Cold* is simply the absence of heat; and as heat has to be removed, no matter in what form, it still does and will call for cost in energy. A recapitulation of steam as a power, and the numerous improvements for its more economic use, is the best possible illustration that the principle has not been in any way changed.

Improved mechanics, producing a greater power for the same amount of coal, has been and will be the advancement in that particular branch. A pound of coal contains so much combustible, and a pound of water evaporated so much expansive, force; and any and all means that give greater results from these fundamental causes in force is legitimate, and tends to good commercial results, just as does any legitimate means used to remove a greater number of heat units from any specific article for less cost of energy, come fairly in the line of improvement.

That there has been rapid progress in the improvement of refrigerating machinery all must concede; and improvement will still go forward—perhaps not as rapidly as in the past, but as surely as time; but the improvements will be in the regular channels and not from the sudden flight of fancy of some so-called genius. As power costs energy, so have the results of to-day in refrigerating machinery cost thought and lots of it; consequently it is highly improbable that some unknown individual shall suddenly spring into existence with more knowledge and brains than are possessed by those who have made this a study of years. In fact, one of the curses of the trade is that so many so-called "geniuses" have foisted on the public failures in this line and have destroyed confidence, rendering it necessary that legitimate builders furnish the most positive guarantees to their customers. This is all wrong. There is a legitimate responsibility, both on the part of the vendor and vendee, and further guaranty should be unnecessary; and yet the purchasers are not so much to blame, for "burned children dread fire."

The last issue of ICE AND REFRIGERATION called attention to one of these "get-something-from-nothing fakes" in the celebrated "refrigerine salts"; and the legitimate trade and all others interested should hail with delight a journal that will be the medium of education on a subject that not only represents a large direct capital, but, indirectly, probably more capital than any other single enterprise. Frankness, and a full and free discussion of the various methods employed in this business can injure no one legitimately connected with it; but, on the contrary, will do good, and cannot fail to fully illustrate to the public that the machine of the future is not in the fœtal stage, but is already *born* into the mechanical world, and remains only to be developed in the ordinary mechanical way.

DRESSING POULTRY FOR BOSTON.

The city of Boston is one of the very best markets in this country for dressed poultry. Her people pay good prices, but they are very particular as to its appearance and condition. The law requires the removal of the entire head, entrails and feathers, and of the crop if it contains food or other substances. In dressing for this market (or in shipping poultry to that market) these points must be observed if the highest prices are expected for shipments: Poultry should be kept at least twenty-four hours without food before killing; then the crop will be empty, and there will be no cause for removal. It should be killed by bleeding at the neck or cutting off the head, but in no case by wringing the neck. It should always be dry picked, which can be easily done while the bird is warm, but in no case should it be scalded, as the skin is sure to break, and it lessens the value at least one-third. After picking (the wing and tail feathers should always be removed), the entrails should be drawn by making as small an incision as possible, and the heads cut off, then hung up and the blood thoroughly drained from the neck. When partially cooled draw the skin over the neck and tie it; then let it hang until thoroughly cooled through (but not frozen), when it is ready for packing. In packing, new boxes holding about 200 pounds should be used, if possible. Paper may be used on the bottom and sides of boxes, also on the top, to keep the dirt and dust from the poultry. Each box should be packed as closely as possible, and the cover pressed on; then it will keep in place and look the same when it arrives there, as when it was packed. On no account should poultry be scalded. All fowl should be well washed in clear, cold water, and wiped with a clean cloth before being hung up to cool, but if scalded they will be sold as such, as a depreciation of value of nearly or quite one-third. No paper, straw or other material should be used in packing the birds. Pigeons are not dressed at all, the necks being wrung, and they should be carefully packed in small boxes. Grouse, partridge and quail should be carefully wrapped in paper and packed in small boxes, with the heads down. Never in any case should the entrails be removed, though this is allowed in some cases with pigeons in very hot weather.

DESIGN FOR AN ICE HOUSE.

The accompanying design and specifications are for a 35-ton ice house as furnished to *Carpentry and Building*, by C. H. Leonard, of Grand Rapids, Mich. While the house is a very small one, and useless for the purposes of the general ice dealer, the design itself is admirable, while the bill of materials may be increased to meet the requirements of a house of any size.

Referring to the illustrations, Fig. 1 represents a plan view, Fig. 2 a vertical section, while Fig 3 shows the northern elevation of the building. In each figure similar letters refer to similar parts. Referring to the plan view, Fig. 1 of the illustrations, *A* represents doors, which should always face the north: *B* are loose boards designed to hold the sawdust at the doors: *C* is a ladder, and *D* is a ventilator. The dotted portions represent the sawdust filling, while the arrows indicate the direction of the air currents constituting the circulation. According to the directions given by the designer of this ice house, the space required is 12x12 feet. A dry place, with sandy or gravelly soil, should be selected for the site of the building, in order that the water may run off freely. If the soil is clay an extra foot of sawdust should be used in the bottom. The sills are 2x12, and should be bedded two inches in the ground, so that no air can get beneath them. A coat of tar on the timber will add greatly to its durability. The 2x6 studs are set up on the inside edge of the sills, and the inside boarded up with sound cull lumber, making it as tight as possible. The outside of the 2x6 studs is next boarded up in the same manner, the space between being packed solid with sawdust as the work progresses. Around the top a space six inches wide is left for the circulation of air, as clearly indicated by the arrows in Fig. 2 of the illustrations. These boards should run up beside the door two inches on each side, for the purpose of supporting the loose boards represented at *B* in Fig. 1. The next step is to set up the 2x4 studs on the outer edge of the 2x12 sills, and toe-nail them to the other boards. German siding is nailed on the outside 2x4 studs, leaving a space three inches above the sill all around the house for air to enter, while at the top it is made tight. The plate is put on top of the 2x4, and the roof supports fastened on the plate and studding. It is recommended that the roof be a good one, although it can be constructed of 1x6 pine boards, double thickness, with lap joints and tarred felt between. The doors can be constructed of German siding with battens. A cleat should be nailed inside of the 2x4 stuff as a door jamb, and the door provided with strap and staple in order to close it tight. The bill of materials for an ice house of this capacity is given as follows:

4 pieces 2x12, 12 feet, for sills.
16 pieces, 2x6, 20 feet, inner studs.
16 pieces, 2x4, 20 feet, outer studs.
4 pieces 2x4, 12 feet, plates.
3 pieces 2x4, 12 feet, roof supports.
2,000 square feet cull boards, in 12 feet lengths, for inner walls.
1,200 square feet German siding, 12 feet lengths, outside surface.
80 lineal feet 1x4, for ventilator and ridge boards.
430 sq. ft. 1x6, 16 ft. lengths, common boards for roof.
2 squares of tarred felt between the roof boards.
2 pieces 1x6, 12 feet lengths, for door battens.
2 pieces 2x4, 20 feet lengths, for ladder ties.
72 lineal feet 1x3, for ladder steps and door jamb.
8 9-inch strap hinges for the doors.
4 sets hooks and staples.

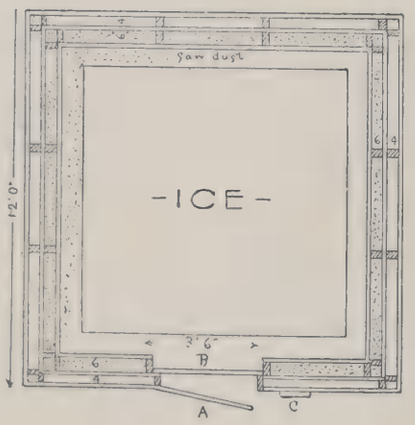


FIG. 1. PLAN VIEW.

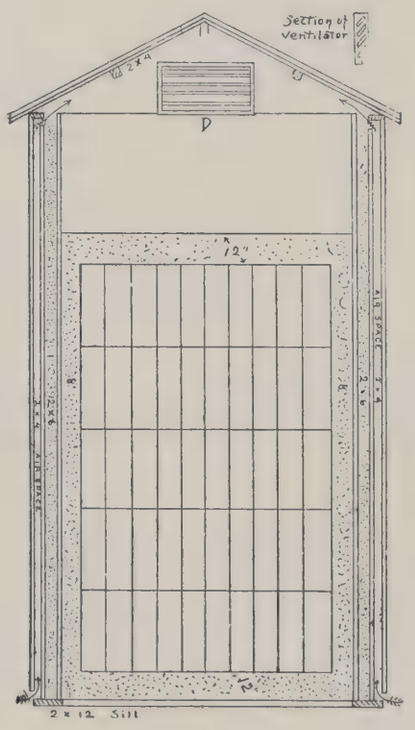


FIG 2. VERTICAL SECTION.

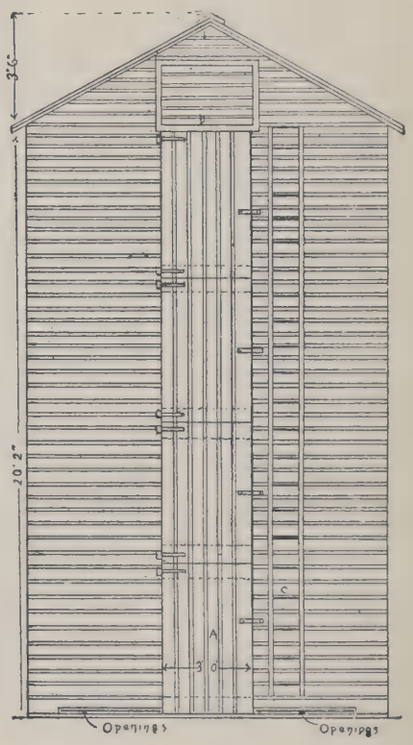
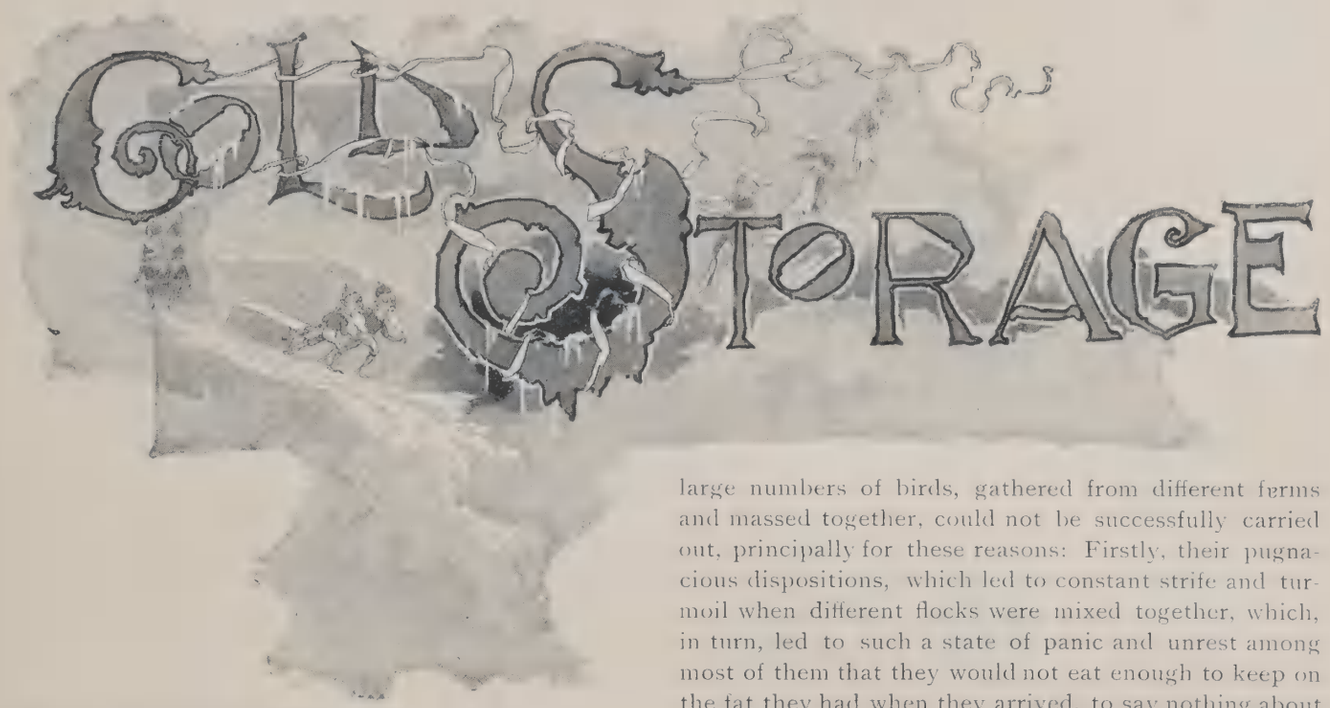


FIG. 3. NORTHERN ELEVATION.

When putting in the ice it is best to set it on edge, leaving a space of eight inches all around between the inside wall and the ice, to be filled with sawdust. Shave off the top of each layer of ice, so that the next layer will tightly fit. The ice should be set as close together as possible, and covered with sawdust. It is well to leave at least three feet space below the eaves for ventilation. As stated above, the size of this ice house is 12x12 feet in plan, and measures twenty feet to the eaves. The same general plan as that herewith presented can be used for the construction of any size of house that may be required.



[*Written for* ICE AND REFRIGERATION.]

PRACTICAL COLD STORAGE.

THE HANDLING OF POULTRY—THE BEST WAY TO FREEZE AND PACK DRESSED POULTRY—THE FATTENING OF LIVE TURKEYS—THE STORY OF A POULTERER'S EXPERIENCE.

By D. B. Beemer.

[*Continued from November issue, page 280.*]

In 1866 I sold out my book and stationery business, and with others took a speculating trip across the plains to Salt Lake City and the Mormon towns south and north of it, jobbing goods to the Mormon merchants, returning in October and November through the snow and ice, by mule train and "bronchos"—44 days to Grand Island, Neb., which point the U. P. R. R. had just reached from Omaha. When I got back to Wisconsin, I found that one of my neighbors had imitated me in the poultry trade, as well as he was able, and utilized my turkey crop by buying and dressing it off for the Boston market. The next fall I mapped out still larger operations. Through offering a home market for poultry, where each producer could bring his or her crop and get a fair price for it in cash without the bother of "dressing" it, free from the usual uncertainties attached to the selling of it in the local markets and the consigning of it to Chicago, I had encouraged production to such an extent that I found, when I went over the ground to contract, that about all the women and children on my "beat" were embarking in the business of raising poultry, and that in consequence there would be a large crop. I therefore secured an isolated piece of ground, upon which I fenced in a large yard with a high picket fence, and built in the center of it a large frame shed, open on all sides, to the height of three feet from the bottom, or ground, to give the poultry free access to the roosts, while leaving no inclosed corners for them to pack up in and smother in case they did not all get on the roosts in time. I not only bought turkeys that fall, but chickens also. I nursed them through for six weeks—several thousand live birds—under many disadvantages which developed in my effort to fatten them; but at the end of the season I had demonstrated to my satisfaction that the plan of fattening large numbers of birds, gathered from different farms and massed together, could not be successfully carried out, principally for these reasons: Firstly, their pugnacious dispositions, which led to constant strife and turmoil when different flocks were mixed together, which, in turn, led to such a state of panic and unrest among most of them that they would not eat enough to keep on the fat they had when they arrived, to say nothing about adding to it. Next, the massing together of so many caused disease among them, notably "roup." This last, I judged, was largely due to the damp, foul air in the roost building, caused by a heavy accumulation of "droppings," which, because of the maze of roosts in the building, could not be removed. I saw that it was necessary to make radical changes in my plans, in order to handle the crop successfully thereafter. I therefore bought three acres of ground (smooth prairie), an oblong square, lying, the long way of it, north and south, between two streams of running water on its east and west sides, with that from the east side turning west across the north end, and joining the one on the west side. About two acres of this, at the north end, were made an island by a stream of water cutting across from one side stream to the other. I inclosed the west, north and east sides of this island with a tight board fence, five feet high, upon and in front of which I erected a continuous shed roost (like that I first used in the business), with its front opening out into the hollow square formed by it in the center. The roost was provided with an alley-way in front, between it and the feed yards (which yards occupied the whole center space inclosed by the three sides of the roosts), where a man could go around with a wheelbarrow and remove all the "droppings" from the roosts, bringing them to the front with a long-handled scraper. I ran division fences at intervals from the back walls of the roost shed across through to the feed yards, to hold colonies of about 500 turkeys each, with the idea that such a comparatively small number would soon fraternize, become peaceable, and attend to their feed. I ran a high picket fence about the balance of the land from the two south ends of the shed roost, its south front lying along a street. Fronting this street, I built an office building, a granary, with wagon scales outside to drive loads of poultry upon and weigh, and a long building to dress off the birds in, with a slaughter pen in its rear, and set a cauldron kettle in brick work, in which to cook feed for the birds. Then, with a wagon bridge over the cross-creek to connect with the island, on which were the roost and feed yards, I completed what I considered an ideal poultry ranch.

But the most radical change from the previous year's programme, perhaps, which I made, was this: Believing that the proper place to fatten poultry to the best advantage was its native barnyard, I contracted that birds should not be delivered at the yards before December 1, when they would presumably be well fattened and ready to dress off. I would then have but a short time, comparatively, to hold them while gathering them in and waiting for weather cold enough to slaughter and freeze them, while, with my improved sanitary and feeding arrangements, I expected to keep them in good condition. I added that year geese and ducks to the family, and these had a fine place to disport themselves in the waters of the cross creek in front of the feed yards.

As I remember, I gathered in some 10,000 live birds that year off the same ground I at first started with, and had an interesting family. Besides these, my growing business in this line had attracted not only attention but competition as well, and another party set to buying also, and got several thousands of birds off this same ground.

The "colony" idea worked all right, and with enforced routine in feed, as formerly described, I had no difficulty in keeping them fat, while the cleaning of the roosts kept them healthy. When the weather set in around "zero," with "sun-dogs" sullenly flanking the sun, we set at it in methodical packing-house style, and soon had them dressed off and frozen up in tierces and on their journey to the Boston and New York markets in the Michigan Central's new Davis refrigerator cars, which I accompanied through.

The packing house before referred to had, at one side and through the center, two bins about three feet high, running the length of the house, having iron hooks attached to cords fastened to joists overhead, and hanging at intervals of three feet inside and over the bins. Along the remaining side ran a board platform for the "dresser's" use, at the head of which stood a foreman, whose business it was to receive each bird from the pickers and give a check for it, if found properly picked. The day before the one decided upon to begin slaughtering, we would drive about 1,000 turkeys into the slaughter pen, and let them remain over night without feed, so as to insure empty crops for next day—these being left in the birds in the Boston style of dressing. In the slaughter pen close to the swing trap door in the rear of the pick house, stood a butcher's block. At break of day, two boys would enter the pen, and begin on the turkeys. One boy would catch a turkey by the legs and lug it to the butcher's block, where the other boy would seize the turkey by the head, and drawing it down upon the block, with one blow of his hatchet would chop it off, together with a section of the tautly outstretched neck. The first boy would then pitch the flapping turkey against the swing door of the pick house, and its weight would carry it through inside, where the women and girl pickers would scramble for them, seize and hang them up on the hooks and pick dry while warm. When properly picked, they were carried to the foreman, who passed them to a woman, who washed their feet and legs clean in hot water, and passed them to another woman, who, cutting out a bit of the neck bone, wiped the stump clear of blood, and, drawing the skin forward over the stump, tied it neatly about with a cord, and in turn passed them along to a line of "drawers," who, when done with them, pitched them through windows upon the cooling platforms outside, where a man kept assorting them over and packing them in boxes or tierces as they began to stiffen with frost. The open packages remained on the ground till the work was done at night; then they were removed to a warehouse, which had provision for free access of outside air, where they remained open until solidly frozen before heading up.

As the crop that year had increased beyond my means to handle it, encouraging rivals to embark in the business and use the surplus stock offering, I took steps to provide for the handling of still more birds the following season. Being engaged, also, in the fruit and game trade with H. P. Stanley, the commission merchant, then and long afterward doing business on South Water street, Chicago, I got him to take an interest with me in the poultry business, and he put up the sum of $15,000 cash for me to invest in it for him. In October I closed up a peach shipping trade in Chicago, and went up to take hold of the poultry trade with a strong hand.

With the prospective large crop in view, I concluded that it would be best to build cold storage rooms to hold the crop till ready to ship. They would also be useful in case the weather changed while we were butchering and before the stock was properly frozen to carry it safely through to colder weather, when it could be properly finished. Accordingly I built several rooms in my warehouse, and put the "ranch" in good running order all around for the coming campaign. To be brief, the crop seemed to double each succeeding year, for when we began slaughtering that fall we had over 20,000 live birds in the yards—turkeys, geese, ducks, chickens—while the rival buyers had half as many more. Of these, fully 10,000 were turkeys, all grown on the same ground, from which I was able to get but 500 the first year. This shows how such an industry can be fostered and increased by offering a home market with fair prices for the product.

[TO BE CONCLUDED.]

TO PRESERVE grapes for winter use it is necessary to place them in a cool, dry storage room, or cellar, where the temperature will remain only a few degrees above freezing; 34° is the right temperature. The grapes should be gathered as soon as ripe, carefully assorted, removing all immature and imperfect berries: then carefully packed in shallow boxes, drawers or baskets of about ten pounds each, and carried into the storage room. Moisture should not be allowed to collect on the fruit. Keep the room dark as well as cool. Some varieties keep much better than other: those with rather thick skins and firm pulp are usually the best for long keeping, but half ripened or frosted fruit will not keep well under the most favorable conditions. Catawba, Delaware and Niagara may be kept in good condition until February or later, but the Concord rarely holds out much later than January, and more often is gone in December.

THE outlook for export beef, whether under the refrigerator system or as live cattle, is believed to be brighter at present than at any other time in the history of the American cattle trade.

[*Written for* ICE AND REFRIGERATION.]

HOLDING EGGS IN COLD STORAGE.

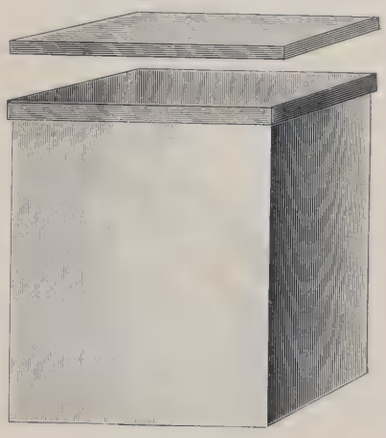
FURTHER INFORMATION ON THIS IMPORTANT SUBJECT—A NOVEL METHOD IN USE BY A LARGE CONSUMER OF EGGS.

BY Mr. D. B. Beemer the problem of holding eggs in cold storage has, in previous issues of ICE AND REFRIGERATION, been ably discussed from the standpoint of the dealer; and the conditions of the problem have been quite clearly pointed out. The columns of this journal, however, are always open to other managers of cold storage plants for the discussion of this important topic; for in the future the cold storage plants will be more and more called upon to meet it in a scientific way. It is of no value to the trade or to the consumer if eggs be merely preserved from putrefaction, if the freshness and sweetness of the egg become depreciated during the period of storage. The real preservation of the egg, as Mr. Beemer has shown, is much more difficult of accomplishment than is commonly supposed: that is, the preservation of eggs in their shells in cases, ready to market to the general consumer as they come out of cold storage in the fall or winter. There is, however, still another way of keeping eggs, which, we apprehend, will be new to the majority of our readers, and which has been called to our attention by Mr. Henry J. Evans, manager of the New York Biscuit Co., on Desplaines street, Chicago, manufacturers of the famous "Kennedy" biscuit, cakes, etc.,—goods which are as familiar as "household words" in all parts of the United States; and to the courtesy of Mr. Evans is due this article, descriptive of his method of preserving the 30,000 to 40,000 dozens of eggs purchased by him in April and May, and consumed in his factory during the fall and winter months.

Mr. Evans for years encountered the difficulties to which Mr. Beemer has called attention; that is, the eggs in fall and winter had lost their freshness, and were frequently musty, and, therefore, useless for his purposes, the conditions of which demand a fresh, rich, meaty egg that will beat up light, as well as impart to the cake that rich flavor which is obtained only from the fresh laid egg of the spring months.

In order to store eggs that would fill these requirements whenever withdrawn from storage for consumption, Mr. Evans undertook an experiment which was a radical and, to him, entirely new departure. His success has since led some others in Chicago to adopt his method, but before he had thus stored eggs the plan had never been heard of in storage circles in Chicago, at least. It may be premised that in his factory Mr. Evans but seldom finds it necessary to separate the whites from the yelks, and that all measurements in mixing formulas are by the quart or gallon, and not by the dozen—two facts, as will be seen, that go far to simplify the problem.

Some four years ago last spring, therefore, Mr. Evans had five heavy tin cans made, rectangular, $9\frac{5}{8}\times13$ inches, inside measurement, with a band of strap iron around the top of the can, with a tight fitting tin cover to slip down over and outside the flange made by the strap iron, making a firm and tight receptacle. The eggs were first broken into small pans so as to facilitate the removal of any bits of the shell which might drop in with the meat of the egg, and to avoid loss in case of a spoiled egg being broken. From the pans the eggs were then turned into the cans, which were filled to within one inch of the top, each can holding five gallons, or from thirty-five to thirty-seven dozen of eggs. A clean cloth was then spread over the mouth of the can, the cover forced down tight, and then the eggs were put in a freezing room and frozen solid. In the following fall the first can of eggs was removed from the freezing room, thawed out in the natural temperature of the factory, and used. The result satisfied every expectation or hope. They were as full of life, as sweet and as fresh as the day they were put into storage, and their flavor as rich and luscious as new-laid eggs. The following spring the experiment was conducted by Mr. Evans on a larger scale, 100 cans of eggs having been stored for fall and winter use. A year ago 301 cans were stored, and last spring 720 cans, or nearly 40,000 dozen. Of the 406 cans of previous years, and such of this year's store as has been drawn on, less than half a dozen cans have been lost, being musty; and the cause was afterward traced back to a shipment of musty eggs which had been overlooked and sent to the cold storage house with the others.



EGG CAN.

This is certainly a remarkable record, and is conclusive of the fact that eggs can be put into cold storage with the certainty that they will come out in as perfect condition as when put in, by being frozen and kept frozen until wanted for use. This system, of course, is useless for the general storage of eggs to be retailed by the dozen, after storing, to consumers, who are accustomed in the kitchen to measure eggs by number and not by quantity, and who more frequently than is the case with large consumers, separate the whites from the yelks; and, besides, the eggs must be used as soon as possible after thawing out, as thereafter they depreciate in a comparatively short time; but for large consumers, restaurants, hotels, etc., the plan of Mr. Evans certainly solves the problem.

DR. MEYER, the Danish commissioner to the Columbian Exposition, recently asked the grounds and buildings committee to erect a special building, 80×100 feet, for the Danish dairy exhibit. He said the dairymen of his country would require a building of that size, and that if the exposition would furnish it he would guarantee to fill it. The committee asked Dr. Meyer to furnish a statement of what his countrymen would do after he returned to Europe, and the matter would then be decided.

ICEBERGS have been seen in the Antarctic ocean which rose 400, 700 and 1,000 feet above the water, and were from three to five miles in length.

NEW COLD STORAGE PLANTS.

There is nothing special to say this month on building operations, which, as will be seen, include one or two important plants, and some smaller ones. The great need of the country generally is for cold storage in the lesser cities, nearer the farms. These will come in time: but like all great improvements of whatever sort, they will come slowly—especially in the northern states, where for a large part of the year such storage is not looked upon as of as great importance as it really is. Our monthly record of new plants, enlargements, etc., is as follows:

ILLINOIS.

Murphysboro—Rudolph Stecher, St. Louis, has ordered from the American Ice Machine Co., of St. Louis, a 20-ton ice and refrigerating machine for his brewery.

IOWA.

Keokuk.—The Gettleman Brewing Co. is erecting a cold storage house.

Muscatine—A movement is on foot to organize a stock company to build and operate a cold storage warehouse. The suggestion of the local paper that "there are a number of buildings in the city that could easily be converted into a well equipped storage warehouse, and the outlay of money would not be very large either," may be taken *cum grano salis*, so to speak.

KANSAS.

Wichita—It is reported that the Pabst Brewing Co., of Milwaukee, is going to erect a cold storage warehouse, and ground will be broken for the building very soon now.

KENTUCKY.

Lexington—John F. Price has commenced operations with a new machine from the American Ice Machine Co. of St. Louis.

LOUISIANA.

Algiers—The new ice factory will have facilities for cold storage.

Donaldsonville—The Donaldsonville Ice Co., Ltd., will have a cold storage house in connection with the ice factory now in course of erection.

MARYLAND.

Baltimore—The E. D. Onion Ice Manufacturing and Cold Storage Co. is a new corporation in course of organization; capital, $500,000.

MASSACHUSETTS.

Boston—The new cold storage warehouse of the North Provision and Packing Co., to be built near Medford street and Somerville avenue, Somerville, Boston, will be six stories in height, and the ground measurement 123 feet by 186. Terra cotta furring will be the material used for excluding the heat of the atmosphere.

NEW YORK.

Binghamton—The Joseph Lauer Brewing Co., a new brewery now building, has just closed a contract with the Case Refrigerating Machine Co., for two 20-ton refrigerating machines, Mr. Lauer using them in preference to others he had operated in other similar plants.

Canajoharie—The Sweet Refrigerator Co. will enlarge its capacity by erecting a building 40×60 feet.

New York—A Kansas City corporation will erect a cold storage house, Black system, to cost $15,000 to $18,000.

PENNSYLVANIA.

Reading—The Central Ice and Cold Storage Co. has been organized to build a cold storage house at North Reading; capital, $100,000. The company will manufacture ice in addition to operating a large cold storage house.

TEXAS.

Velasco—J. D. Anderson, of Waco, is said to be about to open a cold storage house.

VERMONT.

Brattleboro—Swift & Co. will erect a beef storage house here.

WASHINGTON.

Spokane—The Spokane Ice and Cold Storage Co. has been organized with a capital of $100,000.

WISCONSIN.

Sheboygan.—The Sheboygan Cold Storage Co. has been incorporated by Peter Batts, Edward Hart and Pliny H. Peacock; capital, $10,000.

——On October 20, several of the southern states were astonished by a sudden "cold snap." There were killing frosts at Shreveport and Wilmington, N. C., and a freezing temperature at Chattanooga and Augusta, Ga. At Morristown, Tenn., ice an inch thick formed on still water.



A BIG PACKING HOUSE.

The Denver Rapid Transit and Improvement Co., of which Messrs. Florida, Hammett & Noel, 821 Pine street, St. Louis, are real estate agents, have prepared plans for the erection of what is designed to be the largest packing establishment in the United States. This great plant will be built at Denverside subdivision of East St. Louis, Ill., and the buildings will cover an area of thirteen acres, while the works will employ in the neighborhood of 3,000 men. The project is backed by a Denver syndicate, who are themselves the largest capitalists of Denver and have associated with them several capitalists of St. Louis. The contracts for the erection of the buildings are about ready to be let.

PACKING HOUSE NEWS.

——Indianapolis has been made one of the beef and pork export points by the National Department of Agriculture.

——The Dallas Dressed Beef Co. is enlarging its plant, and the Hercules Iron Works are to put in a twenty five-ton ice making machine.

——John P. Squire & Co., of Boston, are making arrangements to put refrigerating machines into their meat packing establishment, using the brine system.

——R. E. Stafford & Co., are reported as having purchased the packing house, refrigerator works, etc., of the Columbus (Tex.) Meat and Ice Co., for the sum of $10,000.

——The Brunswick (Ga.) Import Co. has been organized for the purpose of packing and shipping fish, oysters and fruits from Brunswick, and will erect a plant for that purpose.

——The assurance of a steady supply of ice from the Tampa Bay Ice Co.'s factory has reawakened the fish trade of that section of country, which depends on a reliable ice supply for prosecuting the business.

——St. Joseph, Mo., is to have a new packing house, and the contract for a sixty-ton complete refrigerating plant has been awarded to the Hercules Iron Works, of Chicago. The plant is to have a capacity of 800 hogs daily.

ICY ITEMS.

——The ice dealers at Albany, N. Y., have "agreed to agree" for next season's business.

——Edward Levitt has purchased J. R. Towle's ice house at Northwood, N. H., and will repair and enlarge it.

——The Jeffersonville (Ind.) Ice Co. and Jeffersonville Brewing Co. are considering a consolidation, in which case a saving of $2,500 to $3,000 can be made.

——The Palmetto Ice Co. and the Columbia Ice Co. have consolidated at Columbia, S. C., and the two plants are operated jointly at the works of the Palmetto Ice Co.

——The Anheuser-Busch Brewing Association are about to put a refrigerating plant in their depot in Chicago, and the contract has been awarded to the Hercules Iron Works.

——The factory of the Tampa Bay Ice Co., St. Petersburg, Fla., has recently been overhauled by Mr. Murray, of the Harrisburg Ice Machine Manufacturing Co., who erected the plant.

—— It is said that the largest casting ever made in the South was an absorber for a 50-ton ice machine for McDonald & Hart, New Orleans, the casting being made by the Ross-Meehan foundry for the Southern Ice Machine Co. The casting weighs eight tons.

——The People's Slaughter House and Refrigerating Co., of New Orleans, offer a premium of $1,000 for plans and specifications for the erection of a modern slaughter house with refrigerator and stock yards. These plans will be received until the 10th of next December.

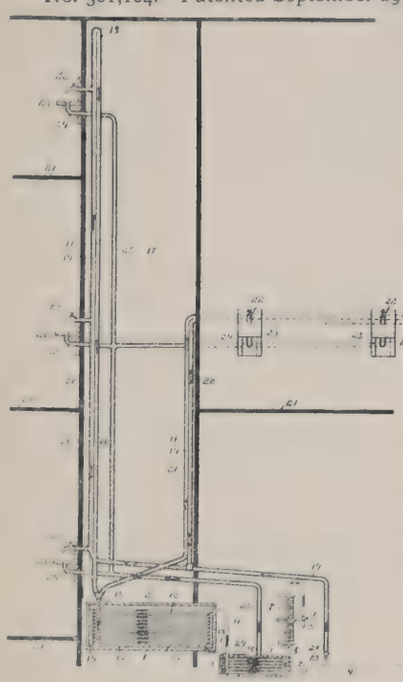
——The Richmond Ice Machine Co. (reorganized), November 6, elected the following directors: S. W. Travers, president; John R. West, vice-president; W. S. Rolin, E. W. Weisiger, G. G. Valentine, G. A. Homer, R. G. Rennolds, H. A. Cobb, John Pope. Mr. Alex. Delaney will probably be made general manager.



We append below the most important new patents, relating to the ice, ice making, refrigerating, cold storage and kindred trades that have been issued from the patent office during the past month, reported expressly for ICE AND REFRIGERATION.

SYSTEM FOR COOLING AND DISTRIBUTING DRINKING WATER.

No. 460,490. Dent Yates and Benjamin Brock, Kansas City, Mo.; said Brock assignor to said Yates. Filed August 6, 1890. Serial No. 361,164. Patented September 29, 1891. (No model.)



Claim—1. The combination of a water cooling device one or more supply pipes extending throughout a building, and a like number of return pipes, water cocks connected with the return pipes, waste water receptacles beneath the cocks, and waste pipes connected with said receptacles and with said cooling device, whereby the waste water is reconveyed to the cooling device, substantially as described, and for the purpose set forth.

2. The combination of the auxiliary cooling box 3, ice box 1, connected with the box 3, cooling coils located in said boxes and connected together, pipes in connection therewith extending throughout a building, and the waste water pipes leading to said box 3, whereby cold water may be conveyed to any part of said building, and the waste water utilized to cool the supply water, substantially as described, and for the purpose set forth.

ARTIFICIAL ICE SKATING RINK.

No. 462,316. Ira H. Jewell and William M. Jewell, Chicago, Ill. Filed March 23, 1891. Serial No. 386,104. Patented November 3, 1891. (No model.)

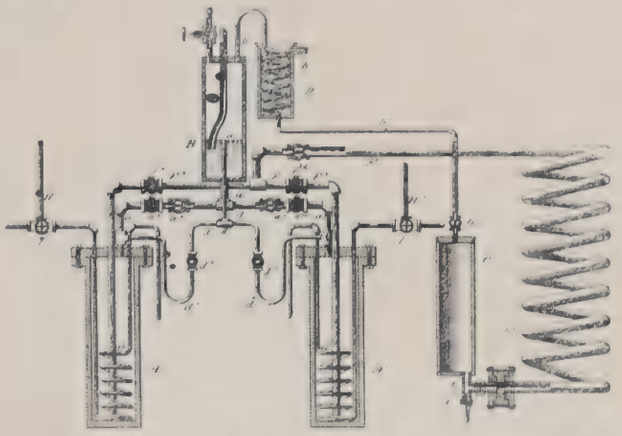
Claim.—1. In a skating rink, the combination, with a tank, of ammonia pipes adapted to conduct ammonia through the contents of the tank, and steam pipes entirely disconnected from and having no communication with the ammonia pipes, and adapted to conduct steam through said tank, substantially as and for the purpose specified.



REFRIGERATING APPARATUS.

No. 462,118. Jacob Erny, Philadelphia, Pa., assignor, by direct and mesne assignments, to the International Freezing and Refrigerating Machine Co., of New Jersey. Filed October 31, 1890. Serial No. 369,382. Patented October 27, 1891. (No model.)

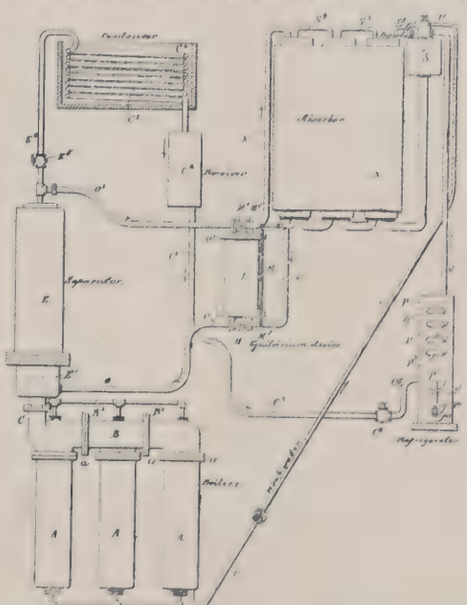
Claim.—1. In an apparatus for cooling or refrigerating, the combination, with the vessel *B*, the cooling coil or worm *b'*, the liquid storage vessel *C*, and the freezing coil *E*, of the twin evaporating vessels *A A'*, each connected with the vessel *B* and to the freezing coil *E* by pipes provided with suitable cocks, whereby vapor may be passed from either of the vessels *A* or *A'* to the other, following the same course through the freezing coils, substantially as described.



ICE MAKING AND REFRIGERATING APPARATUS.

No. 462,551. Frederick B. Hill, London, Eng., assignor of three-fourths to James Sinclair, same place. Filed February 7, 1889. Serial No. 298,986. Patented November 3, 1891. (No model.) Patented in England June 4, 1885, No. 6,808.

Claim.—1. In a refrigerating or ice making apparatus, the combination, with the tubes *A* of the boiler or still, each of which is closed at its lower end and open at its upper end, of a gas chamber *B*, extending across the upper ends of the tubes *A*, and formed of readily separable sections, which are connected with each other, and each of which has secured to its under side one of the said tubes *A*, so that such sections with their attached tubes *A* can be readily removed from or added to the boiler or still, to vary its capacity, according to the amount of work which it has to perform, substantially as set forth.



REFRIGERATOR.

No. 461,006. Orrin M. Whitman, Boston, Mass. Filed January 16, 1891. Serial No. 377,940. Patented October 13, 1891. (No model.)

Claim.—In a refrigerator or butter cooler, the combination of the hoods or caps *I*, secured to the front of the chest above the windows, said hoods or caps being semicircular in horizontal section, and provided with concave under edges, as shown, adapted to fit over said windows when they are swung up, the windows consisting of the panes *H* and frames *H' H'' H'''*, said frames being pivoted to the wall of the chest *A A'*, and said windows

being semicircular in horizontal section, and swinging on a horizontal axis from a vertical closed position to a horizontal open or raised position, and the ice chamber *C*, constructed and located as described, whereby when the windows are closed the bottom piece *II''* of the frames rests on the platform *E*, and the top pieces *II''* of the frames rest against the concave inner sides of the hoods, and when the windows are open the semicircular panes *II* rest against the concave under edges of the hoods and the top pieces *II''* rest against the wall of the ice chamber *C*, so as to substantially cut off the entrance of warm air to the ice chamber, substantially as set forth.

WANTED AND FOR SALE ADVERTISEMENTS.

Engineer Wanted.

A competent engineer wanted for a large ice making and cold storage plant in a city in New York state. Address, giving references and salary wanted, L. & C. S., care ICE AND REFRIGERATION, 177 La Salle St., Chicago.

Ice Machine Wanted.

Wanted, either a 10, 15 or 20-ton second-hand ice machine. Give patent, age and condition, terms with full particulars, present location, cause for selling. Address "B. H." care ICE AND REFRIGERATION, 177 La Salle St., Chicago.

Manager Wanted.

An experienced manager to take charge of our new 125-ton (Smith Plate) ice plant and cold storage warehouses. Must be a man of ability, and expert in cold storage business. A good situation for the proper party. Best of references required. Address W. S. HODGES, Secretary, room 37, Republic Building, St. Louis, Mo.

Ice and Cold Storage Plant for Sale.

The Excelsior ice and cold storage plant, located in the solid and progressive city of Nashville, Tenn. Ice making capacity 80 tons daily, and an additional reserve capacity of 20 tons, cold storage capacity 50,000 cubic feet. This is one of the largest and best equipped plants of the kind in America, and has been a success in every way from the start. For particulars address W. H. HOWE, Nashville, Tenn.

PURE CRYSTAL ICE—NO CONE.

NO CANS
NO BRINE
NO PLATES
NO DISTILLING

New methods used. **Cost Reduced.** Direct Expansion System. Rapid Freezing. Harvested in Blocks of Standard Sizes by the **Steam Ice Cutter.** Can Plants changed to this system.

ADDRESS,

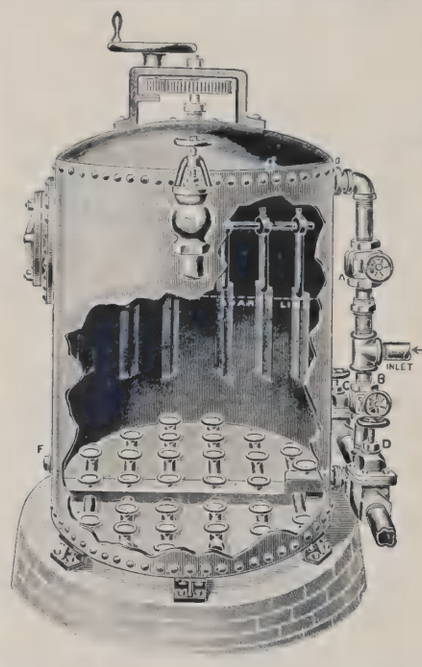
LEA PUSEY.
WILMINGTON, DEL.

O. H. Jewell Filter Co.

73 & 75 WEST JACKSON ST.,

CHICAGO.

REFER BY PERMISSION TO
DIAMOND ICE CO., Wilmington, Del.
CHATTANOOGA ICE CO., Chattanooga, Tenn.



The Filter Medium does not require to be changed; it being cleaned by simply reversing the flow of water. This Filter may be used to purify water for boiler evaporation or for removal of oil from condensed water before passing to the freezing cans, as also for any other duty requiring pure and wholesome quality of water.

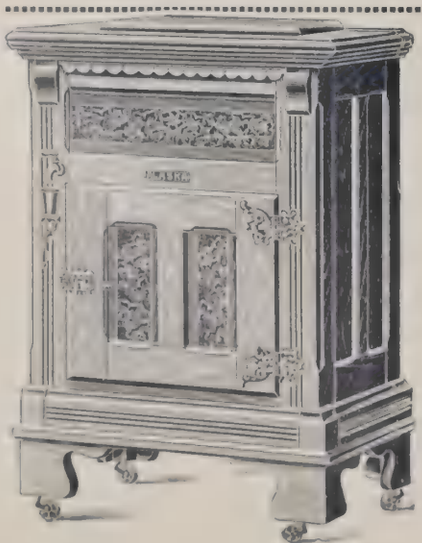
Made in Capacities Upwards of 500 Gallons.

We also manufacture Gravity Filters of any Capacity.

ART IN REFRIGERATORS.

WHY not, as long as we have the skill and the brains to put it there without extra cost to you? Merit should always come before Art in the manufacture of these goods. We, however, have reached the second stage, and now offer you the greatest variety and choicest designs, either plain or combined with sideboards, china closets, kitchen cabinets, etc. We make Refrigerators for every purpose, for Families, Restaurants, Grocers, Butchers, Hotels, Apartment Houses, etc., all bearing our Trade Mark, "THE GLACIER," and having SEVEN walls to preserve the ice, and all our other improvements. "Best in the World." Send for complete catalogue.

THE NORTHERN REFRIGERATOR CO., GRAND RAPIDS, MICH.



THE ALASKA REFRIGERATOR CO.

MUSKEGON, MICH.

WRITE FOR CATALOGUE AND PRICE LIST.
SPECIAL REFRIGERATORS MADE TO ORDER.

F. L. GALIGHER,

ICE AND REFRIGERATING MACHINE SUPPLIES

Machines Purchased, Erected and Results Guaranteed.

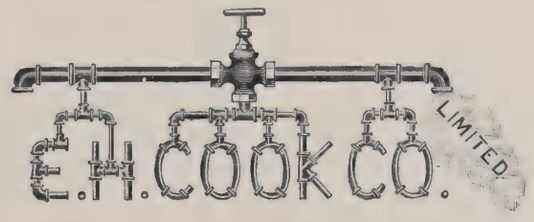
CAPACITY OF PLANTS INCREASED AT A MINIMUM COST.

Repairs and Alterations Made.

. Perfected Distilled Water Apparatus for Ice Factories, Pure Water Co.'s, Chemists, and Caraffe Freezing.

EXPERTS FURNISHED. CORRESPONDENCE SOLICITED.

ROOM 709
CHAMBER OF COMMERCE BUILDING,
CHICAGO, ILL.



ENGINEERS AND CONTRACTORS FOR

Ventilating

WATER AND . . . STEAM HEATING.

ALSO EXPERTS IN

Brewery and Refrigerating

. . . WORK . . .

GREENHOUSE HEATING AND STEAM LAUNDRY WORK.

△ △ △ PUMPS △ △ △

Damper Regulators, Feed Water Heaters, and all kinds of Engineers' Supplies.

Nos. 92 and 94 Andrews Street,

ROCHESTER, N. Y.

A. W. SWANITZ, CONSULTING ENGINEER,

AND EXPERT IN

Ice and Refrigerating Machinery

CORRESPONDENCE SOLICITED . . .

701 STOCK EXCHANGE BUILDING,

CHICAGO.

CRANE COMPANY, CHICAGO.

SPECIAL WROUGHT IRON PIPE

. . . . . For Ice Making and Cold Storage.

EVERYBODY WHO USES ICE MACHINERY

THE BEST AND CHEAPEST BLACKS ON EARTH, ALL GRADES, AND FOR EVERY PURPOSE

NEEDS BONNELL'S NUBIAN IRON ENAMEL

We supply the largest makers and users of Ice Machinery in the world. Write us if you want prices and further pointers.

THE NUBIAN IRON ENAMEL CO., 17 TO 19 NUBIAN AVENUE, (A CHICAGO SUBURB.) **CRAGIN, ILL.**

GROUND CORK

FOR INSULATING PURPOSES.

For Cold Storage Rooms, Refrigerator Cars, Brewers, and all insulating purposes. Large stock on hand which will be moved at low prices.

MACKOLITE . . HOLLOW BLOCKS

UNEQUALED as a non conductor of heat in all dry storage rooms and situations. They are **FIRE-PROOF**, and when exposed to a red hot fire on one side will bear the hand on the other.

MACKOLITE PLASTER BOARD COMPANY,

807 CHAMBER OF COMMERCE, CHICAGO . . .

DIRECTORY OF

Ice Factories, Ice Dealers and Cold Storage Houses.

THE PICTET ICE WORKS,
Manufacturers of Artificial Ice from Filtered and Double Distilled Lake Erie Water.
Capacity, 30 tons per day.
20, 22 & 24 Center St., Cleveland, O.

THE WASHINGTON MARKET CO.
Central, accessible and close to business, with over 300,000 feet cold storage space.
Center Market: 7th and Pa. Ave., N. W.,
Washington, D. C.

CENTRAL ICE CO.
REPRESENTING Lookout Ice & Cold Storage Co.
Chattanooga Ice & Bottling Co.
Ice Capacity, Big Spring Ice Co.
125 Tons daily. Chattanooga, Tenn.

NORTHWEST COLD STORAGE & ICE CO.
WM. McGUIRE, Sec'y and Treas.
C. H. PRESCOTT, Pres. J. C. LEWIS, Vice-Pres.
WM. McGUIRE, Mgr. Portland, Ore.

STANDARD ICE CO.
Daily capacity, 135 tons.
Office: Wall Street.
Factories: Atlanta, Iceville and West End.
MORRIS BENJAMIN, Mgr. Atlanta, Ga.

J. WALTON CURTIS,
ICE BROKER,
Ice bought and sold on commission,
P. O. Box 1264. Boston, Mass.

EXCELSIOR ICE & COLD STORAGE CO.
Ice capacity, 80 tons daily.
W. H. HOWE, Prop. Nashville, Tenn.

GEORGIA ICE CO.---N. O. ICE MFG. CO.
Capac'y, 40 tons daily. Capac'y, 80 tons daily.
J. M. BEATH, Gen. Mgr. H. H. BLANK, Supt. N. O.
Atlanta, Ga. New Orleans, La.

JAMES McCARTHY & SON,
Wholesale and Retail dealers in Ice.
Winter and Summer Shipments.
Lake Bras D'Or, Nova Scotia.

GIFFORD BROS.

HUDSON, NEW YORK.

ICE

ELEVATING
CONVEYING
LOWERING

Send for Catalogue and Price List.

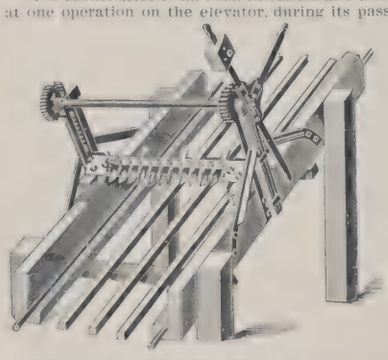
MACHINERY

ALSO

CHAIN, FORGINGS, ENGINES AND BOILERS.

Briggs' Corrugating Elevator Plane

For reducing ice to an even thickness and corrugating it upon the upper surface at one operation on the elevator, during its passage from the water to the house



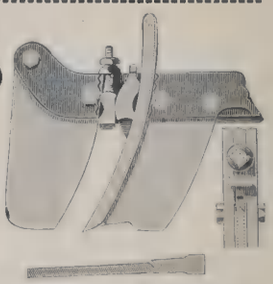
It will cut off any amount necessary, leaves the top of the cakes dry and slightly corrugated. It gives level floors, and the ice can be stored with less labor and will come out very much easier and with less breakage than if not planed and corrugated.

CAUTION.

Planes using cutters which have cutting edges that diverge from the entering point of the cutters, whether made singly or in sections, infringe my rights under letters patent, the users of which I shall hold liable to me in damages.

JOHN N. BRIGGS, Coeymans, Albany Co., N. Y.

ICE TOOLS



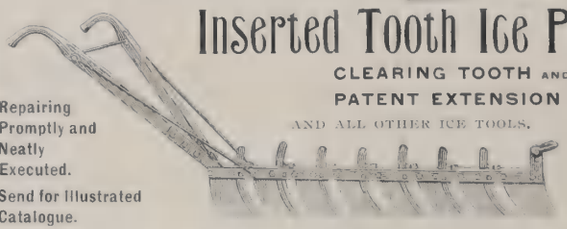
HENRY BODENSTEIN,
MANUFACTURER,
Staatsburg, Dutchess Co., N. Y.

MANUFACTURER OF THE PATENT

Inserted Tooth Ice Plows

CLEARING TOOTH AND PATENT EXTENSION GAUGE

AND ALL OTHER ICE TOOLS.

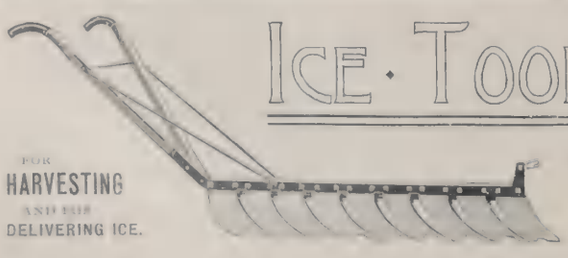


Repairing Promptly and Neatly Executed.

Send for Illustrated Catalogue.

All Work Warranted to Give Satisfaction

ICE TOOLS

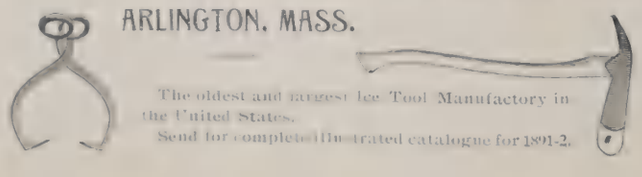


FOR HARVESTING AND THE DELIVERING ICE.

Of Every Description.

MANUFACTURED BY **WM. T. WOOD & CO.**

ARLINGTON, MASS.



The oldest and largest Ice Tool Manufactory in the United States.

Send for complete illustrated catalogue for 1891-2.

PETER GERLACH & CO.

CLEVELAND, OHIO.

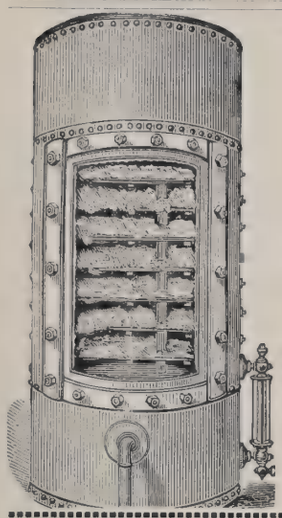
MANUFACTURERS OF THE FINEST

ICE TOOLS

FOR

HARVESTING . .
STORING . . . .
AND DELIVERING ICE.

SEND FOR PRICE LIST.



NEW FEED-WATER PURIFIER AND HEATER

USES LIVE STEAM

This cut shows our Feed Water Heater and Filter combined. Perfectly purifies the feed-water and delivers it to the boiler freed from scale producing elements and sediment. FULLY GUARANTEED.

STILWELL'S PATENT IMPROVED

Lime Extracting Heater. Uses Exhaust Steam. Separates the oil from the Steam and Water. It Regulates the Feed. The Pipes Never Pound. Prevents Scale in Steam Boilers, removing all Impurities from the water before it enters the Boiler.

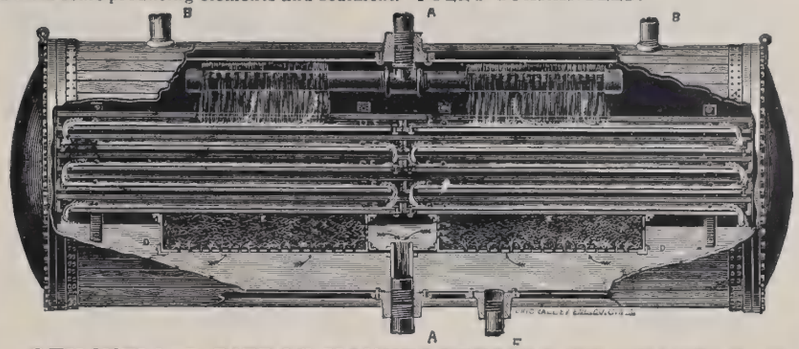
THOROUGHLY TESTED.

Over 4,500 of them in daily use.

This upright view is a fac-simile of the appearance of the shelves of a No. 5 Heater at work on ordinary Lime Water, when the door was removed after the Heater had been running two weeks.

ILLUSTRATED CATALOGUE FREE.

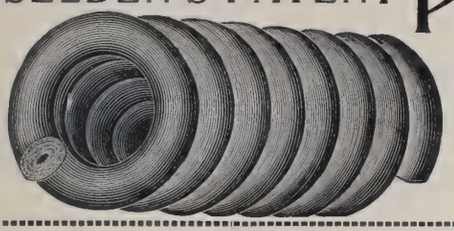
ESTABLISHED IN 1866



STILWELL & BIERCE MANUFACTURING CO., DAYTON, O.

SELDEN'S PATENT PACKINGS

FOR STUFFING BOXES



The BEST Packing for Ammonia, Air, Steam or Water. Used in Ice and Refrigerating Plants in this and other countries. Give it a trial. If your supply store does not keep it in stock, ask him to get it from the manufacturer.

RANDOLPH BRANDT,
38 Cortlandt St.,
New York, U. S. A.

J. G. BODENSTEIN & CO.

MANUFACTURERS OF THE

Patent Inserted Tooth

ICE PLOWS



OLD STYLE PLOWS, AND ALL OTHER ICE TOOLS

Before purchasing elsewhere send for our descriptive catalogue and price list.

STAATSBURG, N. Y.

FOREST CITY PACKING CO.

MANUFACTURERS OF

HIGH GRADE AMMONIA AND ENGINE PACKING . . .

69 FRANKFORT,

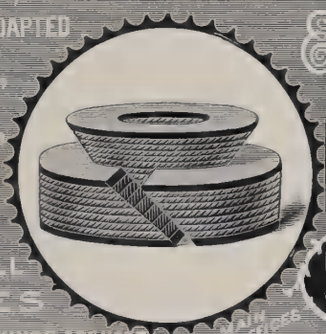
CLEVELAND, OHIO.

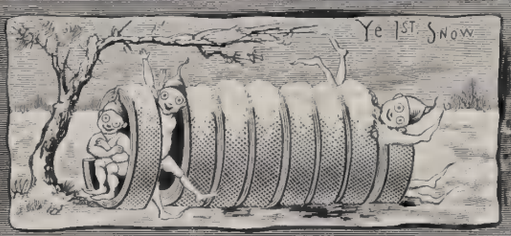
THE GARLOCK PACKING CO.

ELASTIC RING, SECTIONAL AND SPIRAL PACKINGS

ESPECIALLY ADAPTED FOR STEAM, WATER, AMMONIA AND ALL PLACES WHERE PACKINGS ARE USED.

EQUALED BY NONE







PALMYRA, N.Y. ROME, GA. OMAHA, NEB. | PITTSBURGH 54, 5th AVE | NEW YORK 194 WATER ST. | CHICAGO 94 FRANKLIN ST. | PHILADELPHIA 22 & 24 N. 4th ST. | PORTLAND, ORE.

STROMBERG, ALLEN & Co.

RAILROAD AND COMMERCIAL **Printers**

ENGRAVERS
LITHOGRAPHERS
ELECTROTYPERS

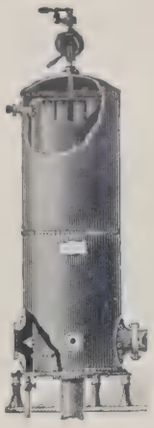
PRINTERS OF
ICE AND REFRIGERATION

MANUFACTURERS OF

LIGHT RAILROAD SUPPLIES

Consecutively Numbered Tickets, Bonds, Checks, etc., a specialty

337 AND 339 DEARBORN ST., CHICAGO



The "STEAM JACKET"
BOILS THE WATER.

WM. BARAGWANATH & SON,

48, 50 & 52 WEST DIVISION STREET,

CHICAGO.

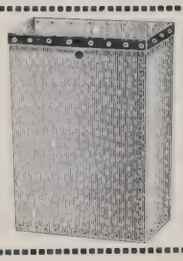
MANUFACTURERS OF

EXHAUST FEED WATER HEATERS
LIVE STEAM FEED WATER PURIFIERS
POWER PUMPS, ETC., ETC.

SEND FOR CIRCULARS.

PAGE & TOLKACZ,
SUCCESSORS TO
DUNLEVY SHEET IRON WORKS.

Galvanized Iron . . ICE CANS



And all Sheet Iron Tank Work for ICE FACTORIES.
WRITE FOR ESTIMATES.
515 NORTH LEVEE, ST. LOUIS.

SEIBEL-SUESSDORF
COPPER AND IRON MFG. CO.
MANUFACTURERS OF

Sheet Iron Tank Work

FOR ICE FACTORIES, PACKERS, ETC.

Also Manufacturers of Galvanized Iron . .

ICE CANS

SEND FOR ESTIMATES.

N. E. CORNER SECOND AND LOMBARD STREETS. ST. LOUIS, MO.

WINGATE & MELL,

MANUFACTURERS OF : : : ICE.CANS

WRITE FOR ESTIMATES.

44 & 46 North Broad Street, ATLANTA, GA.

THE CANTON STEEL ROOFING CO.

.....MANUFACTURERS OF.....

ICE FREEZING CANS

Insulating and Sheathing Papers, . .
Steel Roofing, Corrugated Iron, . . .
Eaves Trough, Conductor, Etc. . . .

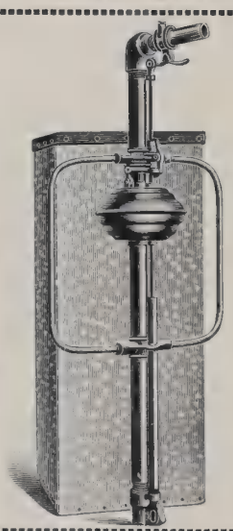
Canton, Ohio.

E. C. SAULS. C. G. SAULS.

SAULS BROS.

MANUFACTURERS OF

Sauls' Automatic Ice Can Filler



Fills Automatically and prevents flooding the bath. Save time, labor and money. Over

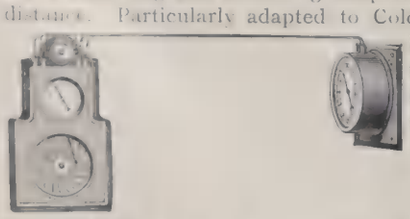
: : 150 : :

In use in prominent factories. Send for testimonials and prices.

SAULS BROS.
COLUMBUS, GA.

Telemeter Instruments.

For recording and indicating temperature and pressure at a distance. Particularly adapted to Cold Storage, to indicate in the office or engine room the temperature in any or all the refrigerating rooms.



FOR DESCRIPTION AND PRICES SEND TO

STANDARD THERMOMETER CO.

PEABODY, MASS.

New York Office, 18 Courtlandt St. Boston Office, 70 Pearl St.



A. WEISKOPF

111 Fifth Ave., CHICAGO,

.....MANUFACTURER AND IMPORTER OF.....

THERMOMETERS AND HYDROMETERS.

Ice Machine Thermometers and Ammonia Hydrometers . . . .

CELLAR AND . . . . . .
CHILL ROOM THERMOMETERS.

Thermometers in angle shape made to order from sketch or specification.

ESTIMATES FURNISHED ON APPLICATION.



IMPORTANT TO ICE MAKERS.

TRI-SODIUM PHOSPHATE CHEMICAL WATER PURIFIER.

PATENTED

A staple salt for the purification of water, ***HOT*** or ***COLD,*** free from injurious action to ice, water or metals.
It prevents incrustations in boilers, and yields an absolutely pure steam for condensing and freezing.
It will prevent incrustations or corrosion to cooling coils, when applied to water passing over them.

By its use the impurities are rapidly eliminated from hot or cold water, by precipitation in tanks, producing a clear, soft, wholesome water for freezing or other purposes.

Send for our book "Worth Knowing," containing valuable information on ***Water Treatment.***

KEYSTONE CHEMICAL COMPANY, Patentees and Manufacturers,

3 South Front Street, PHILADELPHIA. — 65 South Canal Street, CHICAGO.

STRONG TESTIMONY

CHAMPION ICE MANUFACTURING AND COLD STORAGE CO.
COVINGTON, KY., June 27, 1891.

KEYSTONE CHEMICAL CO.

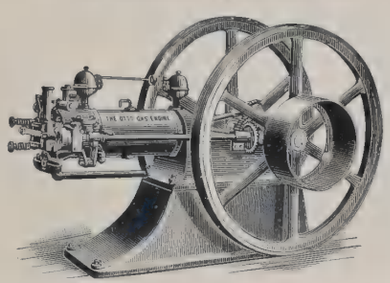
Gentlemen: In answer to your inquiry as to how we like your Tri-Sodium Phosphate, will say that we have been using it for two years with the best of results, both here and at our plant in Ironton, O. We find that it keeps our boilers clean, and the condensed steam from them is absolutely pure, and therefore does not affect the ice manufactured from it in the least. Condensed steam from boilers usually carries an insipid, smoky or bitter flavor with it into ice, but this is entirely overcome. We have the reputation of having the best artificially manufactured ice in this country; it is clear, odorless and tasteless, in fact absolutely pure, and we "bank" our last dollar on your Tri-Sodium Phosphate

Yours truly,
CHAMPION ICE MFG. & COLD STORAGE CO.
R. W. DUGAN, Sup't and Treas.
(COPY)

OTTO

Gas and Gasoline Engines

OVER 33,000 IN USE



BEST AND CHEAPEST POWER FOR

Refrigerating Machines

No Skilled Attendance.
No Boiler, Heat or Danger.
Started at once for short or long duty.
Sizes, ½ to 100 horse-power.
Can be used in country or city.

OTTO GAS ENGINE WORKS, 33d and Walnut Sts., PHILADELPHIA. 151 Monroe St., CHICAGO.

....THE....

HEERDEGEN WATER INDICATOR

We make investigations for subterranean water and furnish reports as to the number of streams, their exact width, direction of flow, approximate depth below the surface, and quantity of flow.

The great advantage of having a well located, is:

1. We locate wells only at such places where we find subterranean FLOWING streams; this is a full guarantee of getting wells, which will never drop off or give out in time of drought, which is the case where wells are supplied by seepage water only.
2. We can follow the course of a subterranean stream for any distance and select the proper place to sink the well.
3. We state the approximate depth of the stream below the surface, which enables our customers to make an estimate of the cost for sinking the well by the foot.
4. Where the supply of an **ARTESIAN WELL** is obtained from a running stream or a spring, instead of seepage water, in **NINE CASES OUT OF TEN IT IS OF GOOD QUALITY.**
5. If there are any springs in the neighborhood where a well is wanted, we can trace the underground outlets of same or the supplying flow for any distance.
6. Where water of low temperature is wanted for cooling purposes, such as for BREWERIES, ICE FACTORIES, distilleries, oil refineries, etc., none cooler than artesian well water exists.
7. Our method of locating wells eliminates all and every risk of failure.

Estimates are given for sinking wells, with guarantee of water, where supply from artesian wells is desired.

We have successfully located a large number of wells.

For particulars apply to

HEERDEGEN & SCHNEE,

48 EXCHANGE PLACE, - - - NEW YORK.

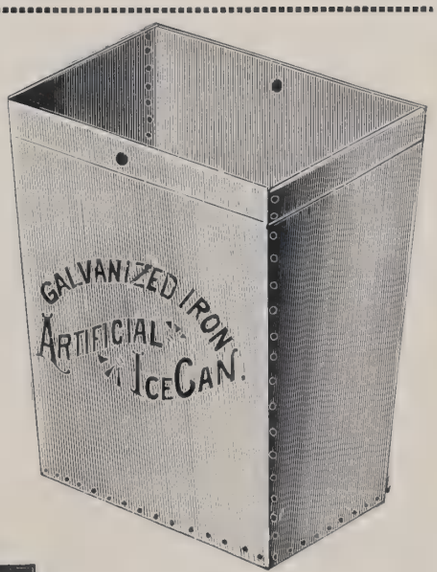
CAPACITY 300 PER DAY.

ICE "CANS" GALVANIZED IRON

WE MAKE THEM BY THE THOUSANDS FOR ICE MFRS. BREWERS AND FOR THE TRADE

READ TESTIMONIALS

WRITE FOR PRICES



NEWBURGH, N. Y., November 29, 1890.

I desire to say that I am pleased with the Ice Cans you have furnished me and they have proved satisfactory to my customers.

ROBERT WHITEHILL.
Manufacturer of Engines and General Machinery.

DAYTON, OHIO, November 28, 1890.

The Ice Cans with which you furnished us in the summer of 1890 have been in constant use during the entire Ice Manufacturing season of 1890, giving entire satisfaction. The material and workmanship could not have been better, and to-day the cans are as good as when shipped from your factory. We can faithfully recommend your cans.

C. SCHWIND,
Dayton View Brewery.

SEE TESTIMONIALS NEXT ISSUE.



GROUND FLOOR SPACE 110X210 FT.

Established 1861. Incorporated 1890.

THE KIECHLER MFG. CO.

LINN, EVERETT and CLINTON STS.

CINCINNATI, O.

WRITE FOR SAMPLES AND FULL PARTICULARS ON

NEPONSET WATER-PROOF FABRICS



POSITVELY THE

BEST INSULATING MATERIAL

FOR

COLD STORAGE AND REFRIGERATOR CARS.

IN FACT ALL REFRIGERATION.

F. W. BIRD & SON, Sole Manufacturers, East Walpole, Mass.

Mineral Wool

BEST INSULATOR FOR . . . . .

ICE HOUSES, COLD STORAGE ROOMS, ETC.

REFERENCES ON APPLICATION. SAMPLES FREE. . . . . U. S. MINERAL WOOL CO. 2 CORTLANDT ST., N. Y. CITY.



AUG. OHLSEN. JOS. MECKLER.

QUEEN CITY Omnibus and Wagon MFG. CO.

Builders of all Kinds of Vehicles.

Cor. Charles and Plum Sts., CINCINNATI, O.

HILPERT & CHANDLER ENGRAVERS BY ALL PROCESSES.

REFER TO CUTS IN THIS PAPER FOR SPECIMENS OF WORK.

167 DEARBORN ST. CHICAGO.

Insulating Linings

EVERY VARIETY FOR REFRIGERATORS, REFRIGERATOR CARS AND COLD STORAGE.

Sectional Pipe Coverings

FOR AMMONIA AND BRINE PIPES IN ICE AND REFRIGERATING MACHINES.

SEND FOR SAMPLES AND PRICES.

H. F. WATSON CO., ERIE, PA.

NEW YORK. PHILADELPHIA. CHICAGO.

P. & B. WATERPROOF INSULATING PAPERS . . .



ARE THE BEST MADE.

They contain **no tar,** are **odorless** and **clean to handle,** made from the best of paper stock; used by the largest and most prominent cold storage and refrigerating plants in the **world.**

P. & B. PRESERVATIVE COMPOUNDS

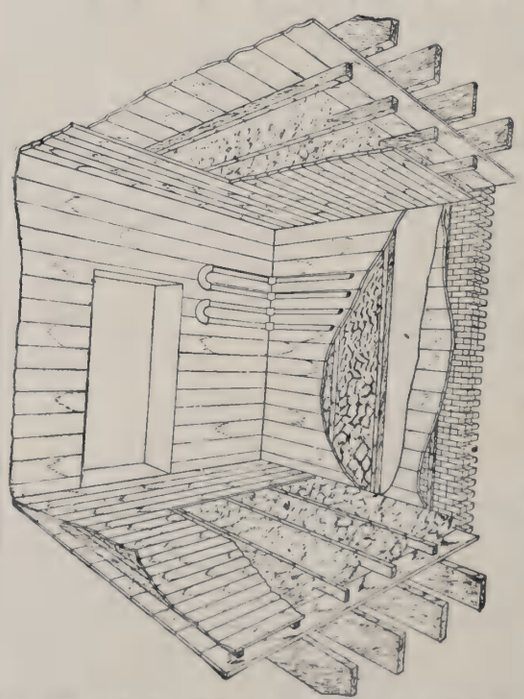
For insulating **walls** and preserving all kinds of **iron** and **wood work** exposed to **dampness,** acids or alkalies. The material is very **penetrating,** always remains **elastic,** will not chip or peel off. We also manufacture a heavy waterproof canvas material thoroughly **saturated** with our P. & B. Preservative Compound. This Material is a perfect **insulator,** strong and very durable.

STANDARD PAINT CO., SOLE MANUFACTURERS,

2 LIBERTY STREET, NEW YORK.

MINERAL WOOL

COLD STORAGE, BREWERIES



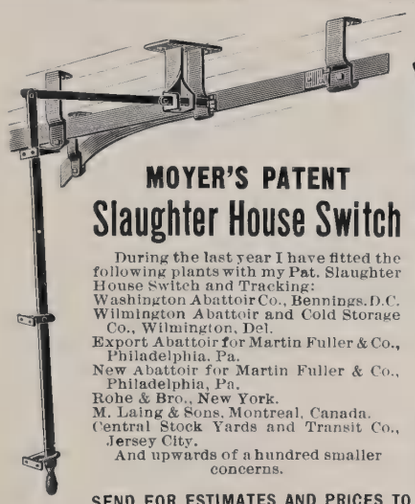
INSULATION

ICE PLANTS REFRIGERATORS.

FOR FREE SAMPLE AND BOOK, ADDRESS

Western Mineral Wool Co.

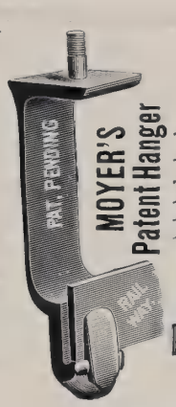
CHICAGO. CLEVELAND. ST. LOUIS.



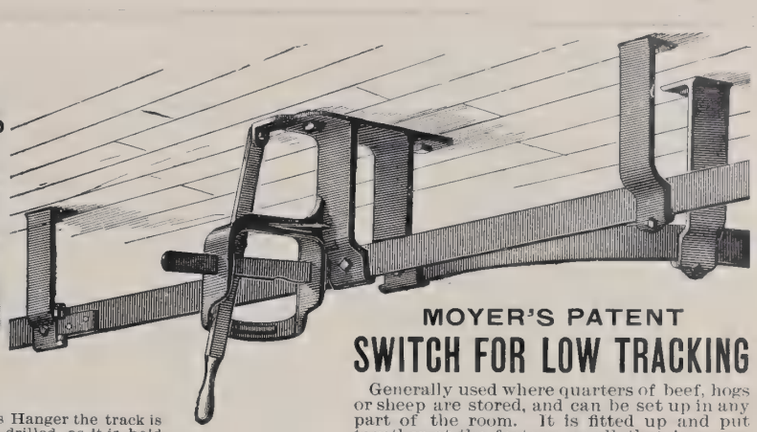
MOYER'S PATENT

Slaughter House Switch

During the last year I have fitted the following plants with my Pat. Slaughter House Switch and Tracking:
Washington Abattoir Co., Bennings, D.C.
Wilmington Abattoir and Cold Storage Co., Wilmington, Del.
Export Abattoir for Martin Fuller & Co., Philadelphia, Pa.
New Abattoir for Martin Fuller & Co., Philadelphia, Pa.
Rohe & Bro., New York.
M. Laing & Sons, Montreal, Canada.
Central Stock Yards and Transit Co., Jersey City.
And upwards of a hundred smaller concerns.



When using this Hanger the track is not required to be drilled, as it is held in position by a clamp bolt, thereby saving the cost of drilling. It affords a cheap and simple manner of erecting the tracking.



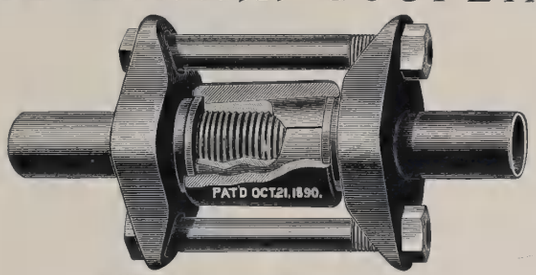
MOYER'S PATENT

SWITCH FOR LOW TRACKING

Generally used where quarters of beef, hogs or sheep are stored, and can be set up in any part of the room. It is fitted up and put together at the factory, so all that is necessary to erect it is to fasten the hanger to the ceiling and the switch is ready for use. This can be done in twenty minutes.

SEND FOR ESTIMATES AND PRICES TO **J. W. MOYER, 14 Broad Street, Philadelphia, Pa.**

THE CLIMAX COUPLING



A NEW AND ORIGINAL INVENTION.
Unsurpassed for Efficiency, Strength, Durability and Economy.
Investigation will establish its superiority over every other known pipe-joint, particularly for Ice and Refrigerating Plants using ammonia.
For further information, testimonials, prices, etc., address

ENOCH LAWSON,
229 FULTON STREET,
SAN FRANCISCO, CAL.

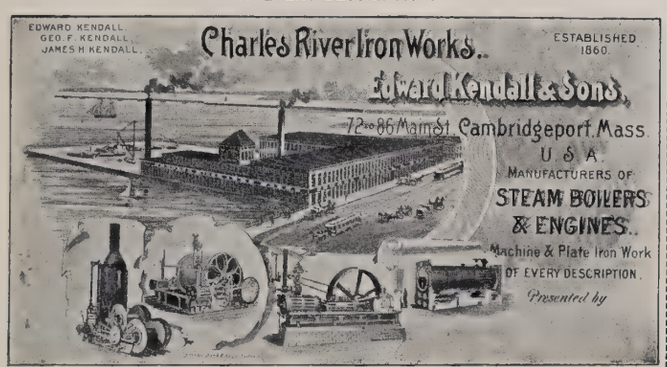
ARMSTRONG MAN'F'G. CO.



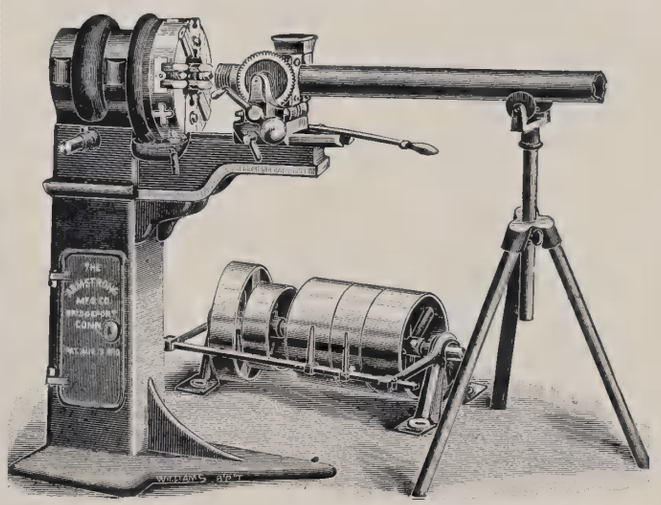
WATER GAS AND STEAM FITTERS TOOLS
BRIDGEPORT, CONN.

TANKS AND SHEET IRON WORK

OF EVERY DESCRIPTION.



CONTRACT FOR THE COMPLETE EQUIPMENT OF
ICE MAKING AND COLD STORAGE PLANTS.

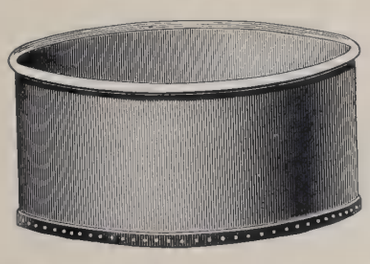


Acknowledged to be the Best, as attested by Hundreds of Letters from parties having them in use, on file in our office.

CATALOGUES FREE ON APPLICATION.

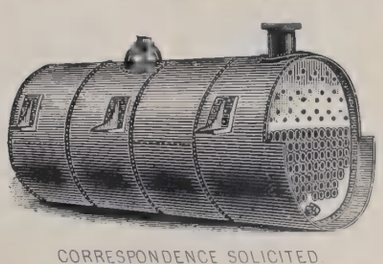
LANSING-IRON AND ENGINE-WORKS

LANSING, MICH.



MANUFACTURERS OF

COMPOUND
CONDENSING
AUTOMATIC
ENGINES.



CORRESPONDENCE SOLICITED

BOILER AND SHEET IRON AND TANK WORK

For Ice Makers and Cold Storage Plants a Specialty.

ATTENTION, CREAMERIES!!!

THE Alexandria Improved Jumbo Separator . .



THE ALEXANDRIA IMPROVED JUMBO SEPARATOR has the largest capacity of any machine in the world, with this size bowl, viz.: 15. With a speed of 6,500 revolutions per minute it will separate 2,500 to 3,000 lbs. per hour. Two horse power will run it. We guarantee this machine in every respect: material, workmanship and separation of cream perfect. The bowl of this separator is forged from steel made especially for this machine. If you need a large separator, call on us. We control the Nelson & Peterson and the Stephens Patent for the U. S. of the Alexandria and Jumbo Separators.

DAVIS & RANKIN BLDG. AND MFG. CO.
240 TO 254 WEST LAKE STREET, CHICAGO.

--- EDSON'S ---

AMMONIA RECORDERS

For Recording "Head" and "Back" Pressures.

Endorsed and Recommended
BY THE
De La Vergne Refrigerating Machine Co.

As being indispensable in enabling the owner of an ice plant to keep the same in hand, and giving him thorough control over it.

I REFER

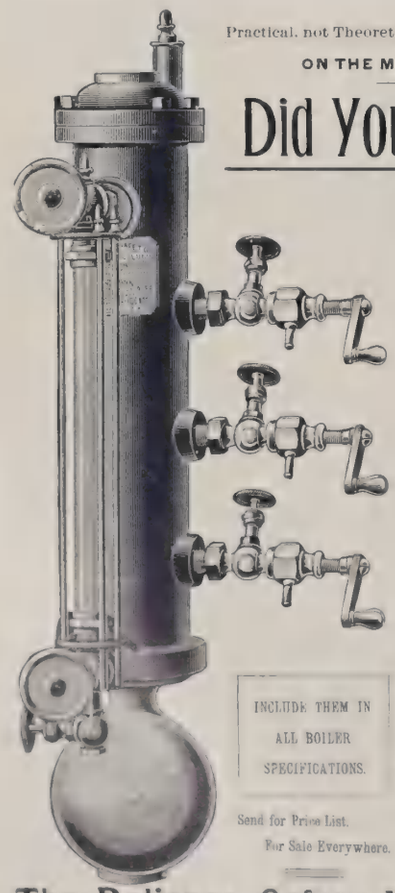
To the following patrons:

Lion Brewery . . . . . New York
Jacob Ruppert . . . . . New York
A. Hupfel's Son . . . . . New York
Consumers' Bg. Co. Ltd., New York
Long Island Brewery. . . Brooklyn
J. & P. Baltz Brg. Co., Philadelphia
Wm. J. Lemp . . . . . St. Louis
Wm. Peter Bg. Co., Weehawken, N. J.
Diamond Ice Co., Wilmington, Del.
Fred Miller Brg. Co. . . Milwaukee
Etc. Etc.



Address Sole Manufacturer,

JARVIS B. EDSON
87 Liberty St.
NEW YORK CITY.



Practical, not Theoretical . . . Over 15,000 in daily use.

ON THE MARKET SINCE 1884.

Did You Ever Stop

to think what
it means
to have the water
carried uniformly
at
the proper level?

IT MEANS
safety,
saving of fuel,
steady power,
and
more of it,
no leaky tubes,
no burned boilers,
no stoppage
for expensive repairs.

ALL
of
which

YOU CAN
secure
for
merely
nominal cost,

BY USING

INCLUDE THEM IN ALL BOILER SPECIFICATIONS.

Send for Price List.
For Sale Everywhere.

The Reliance Safety Water Columns.

THE RELIANCE GAUGE CO.
101 EUCLID AVE., CLEVELAND, O.

PUMP . . . . REGULATORS
PRESSURE



OUR Steam Pump Pressure Regulator has a pressure chamber which is entirely separate from all working parts of the valve, so that any liquid may be kept automatically at a certain pressure in the delivery pipe. We also manufacture other steam regulating devices . . . . . .

Mason Regulator Co. BOSTON, MASS.

THE B. F. GOODRICH CO.

AKRON RUBBER WORKS,
AKRON, OHIO.

MANUFACTURERS OF

MECHANICAL RUBBER GOODS

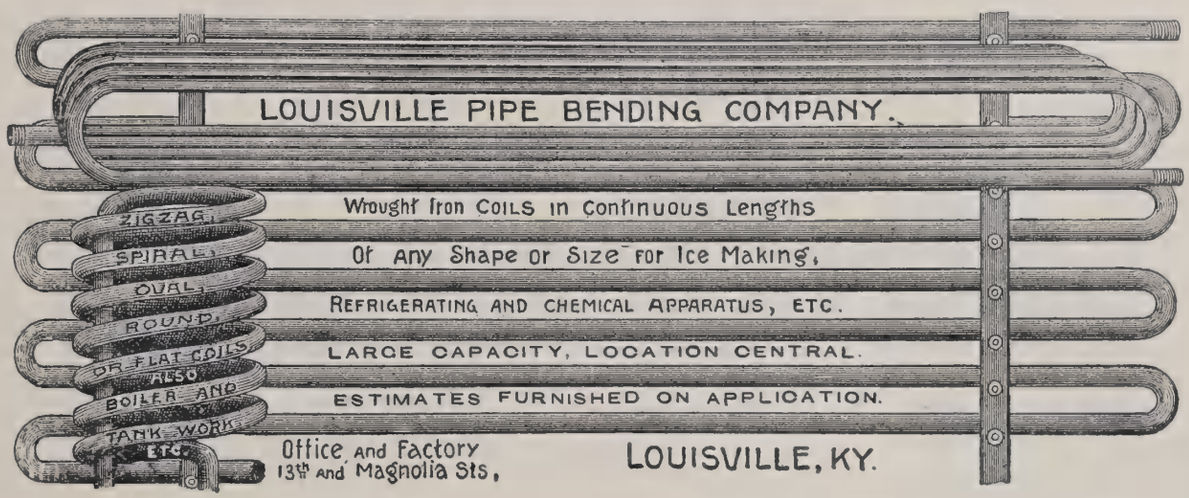
HOSE OF HIGH QUALITY

FOR
ICE FACTORIES
AND COLD STORAGES

Rubber Rings for Ice Machines of all Kinds,
Belting, Valves, Etc.

SPECIALTIES TO ORDER.

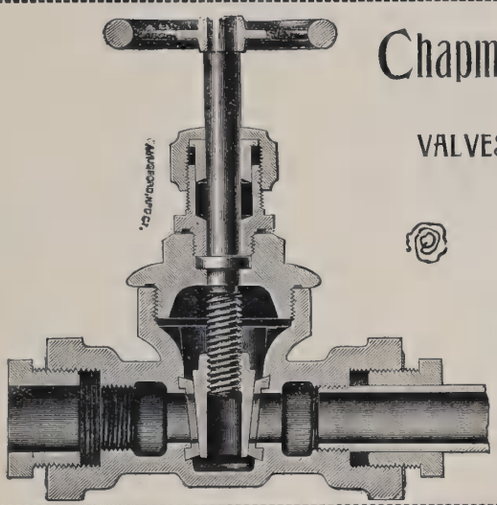
Samples and Prices upon Application.



LOUISVILLE PIPE BENDING COMPANY.

Wrought Iron Coils in Continuous Lengths
Of Any Shape or Size for Ice Making,
Refrigerating and Chemical Apparatus, etc.
Large Capacity, Location Central.
Estimates Furnished on Application.

Office and Factory
13th and Magnolia Sts,
LOUISVILLE, KY.



Chapman Valve Manufacturing Co.

.....MANUFACTURERS OF.....

VALVES AND GATES FOR WATER, GAS, STEAM, ACID, OIL, AMMONIA, ETC.

ALSO GATE FIRE HYDRANTS

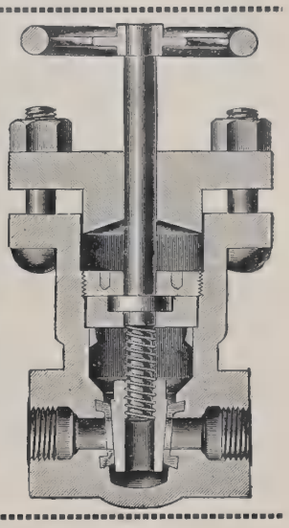
SPECIAL ATTENTION GIVEN TO

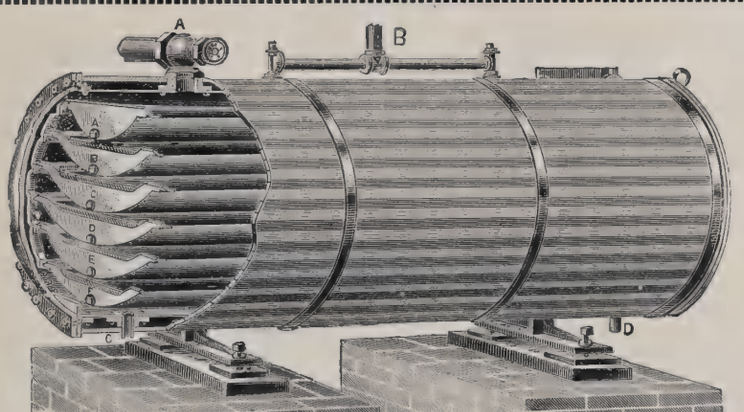
VALVES FOR REFRIGERATING, COLD STORAGE, ICE MAKING MACHINERY, ETC.

We make the best Valve for Ammonia Heavy Pressure in the market. The two illustrations here represent Ammonia Valves that are giving universal satisfaction.

General Office and Works,
INDIAN ORCHARD, MASS

Treasurer's Office,
72 Kilby and 112 Milk Sts.
BOSTON, MASS.





HOPPES LIVE STEAM PURIFIER.

THE

"HOPPES"

Live Steam Feed-Water

PURIFIER

Is especially adapted to ICE MAKING PLANTS, as pure water is essential to insure a good quality of ICE. The use of the HOPPES PURIFIER will insure you pure water, by removing all of the impurities therefrom, at the same time keeping your boilers clean and free from scale without the use of boiler compounds or scale solvents.

CATALOGUES, ESTIMATES, SPECIFICATIONS, ETC., CHEERFULLY FURNISHED.

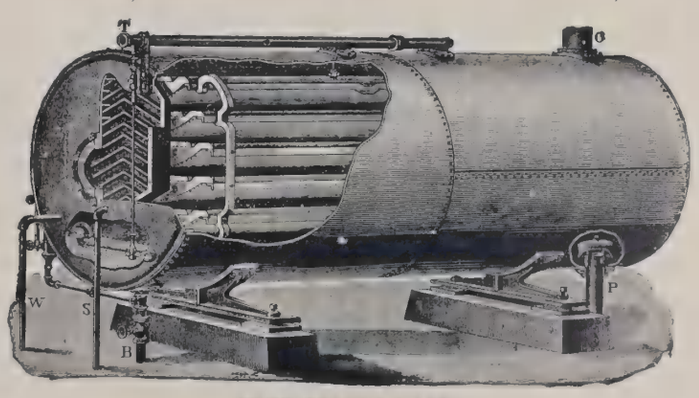
THE HOPPES MFG. CO., SPRINGFIELD, O.

IF YOU WANT TO GET THE FULL BENEFIT OF YOUR EXHAUST STEAM, INVESTIGATE THE

"HOPPES"

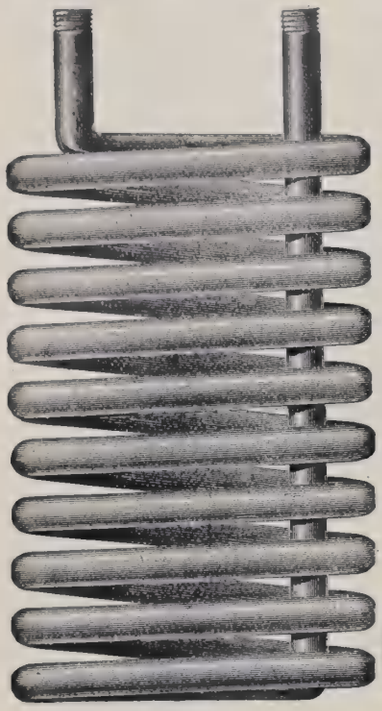
Exhaust Steam Feed-Water

HEATER



HOPPES EXHAUST HEATER

THE HARRISBURG PIPE BENDING CO. LIMITED.



WORKS, S. E. CORNER HERR STREET AND PENNSYLVANIA CANAL. HARRISBURG, PA.

.....MANUFACTURERS OF.....

COILS AND BENDS

Of Wrought Iron Pipe . . in Round, Oval, Zigzag, Spiral, Helical and Tapering Forms.

For Ice Making and Refrigerating

CHEMICAL WORKS, FEED-WATER HEATERS,
BLAST FURNACES, EVAPORATING LIQUIDS,
AMMONIA MACHINES, SOAP WORKS, ETC.

IRREGULAR PIPE BENDING A SPECIALTY

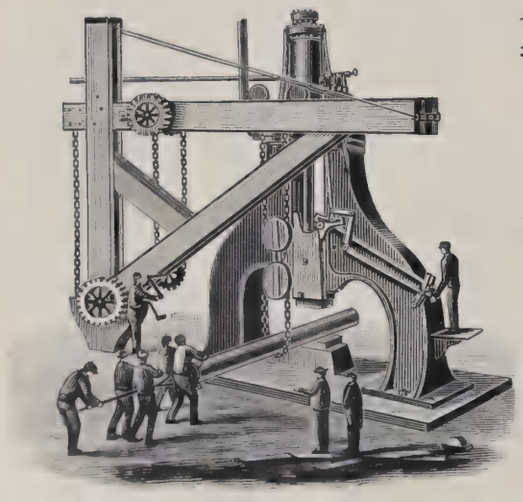


AMMONIA BOTTLE.

AMMONIA . BOTTLES . OR . FLASKS . WITH . WELDED . HEADS

STRAIGHT OR CONCAVE

PIPE WELDING BY ELECTRICITY



THE SAMSON STEAM FORGE CO

OFFICE AND WORKS, CORNER Sacramento and Carroll Aves., CHICAGO.

MANUFACTURERS OF

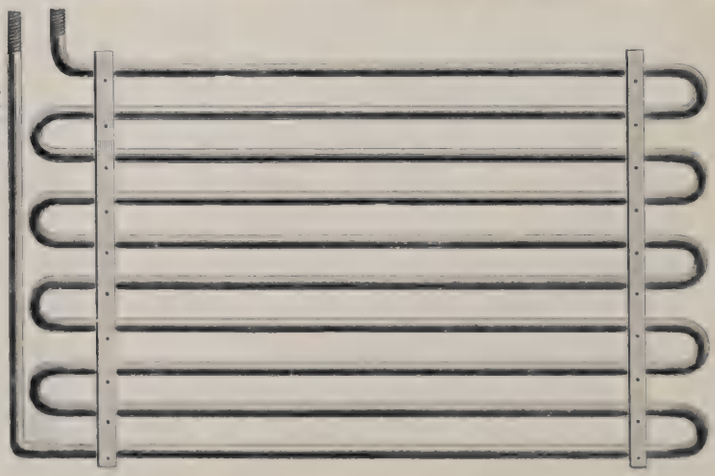
WROUGHT IRON COILS

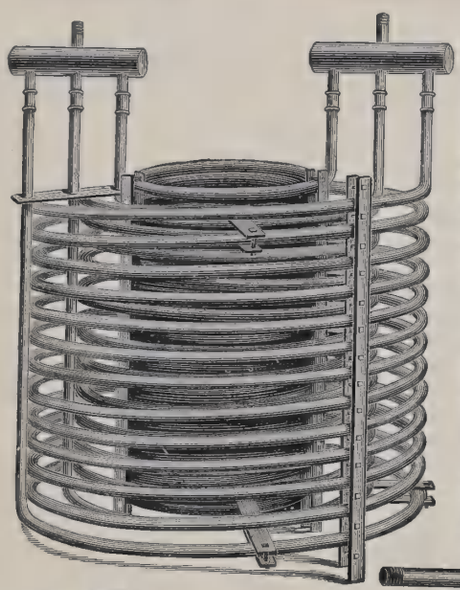
FOR ICE AND REFRIGERATING MACHINES . . . .

AND FOR ALL OTHER PURPOSES

These Coils are tested under water with 500 lbs. pressure, to guard against leaks. A steel ball is passed through each coil to show that its area has not been reduced in bending and welding, and if a leak is discovered the piece is cut out and a new one welded in by electricity. A weld made by electricity never leaks. PRICES ON APPLICATION.



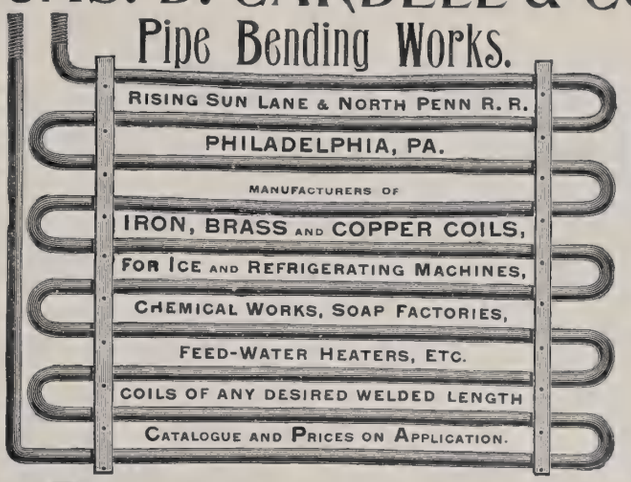




JAMES D. CARDELL. WASHINGTON HOPKINS.

JAS. D. CARDELL & CO.

Pipe Bending Works.



RISING SUN LANE & NORTH PENN R. R.

PHILADELPHIA, PA.

MANUFACTURERS OF

IRON, BRASS AND COPPER COILS,

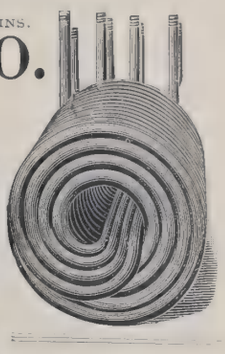
FOR ICE AND REFRIGERATING MACHINES,

CHEMICAL WORKS, SOAP FACTORIES,

FEED-WATER HEATERS, ETC.

COILS OF ANY DESIRED WELDED LENGTH

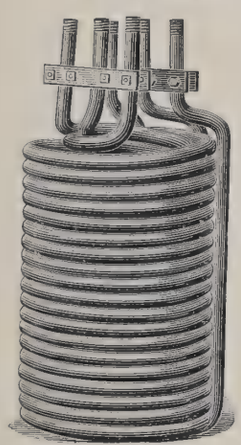
CATALOGUE AND PRICES ON APPLICATION.



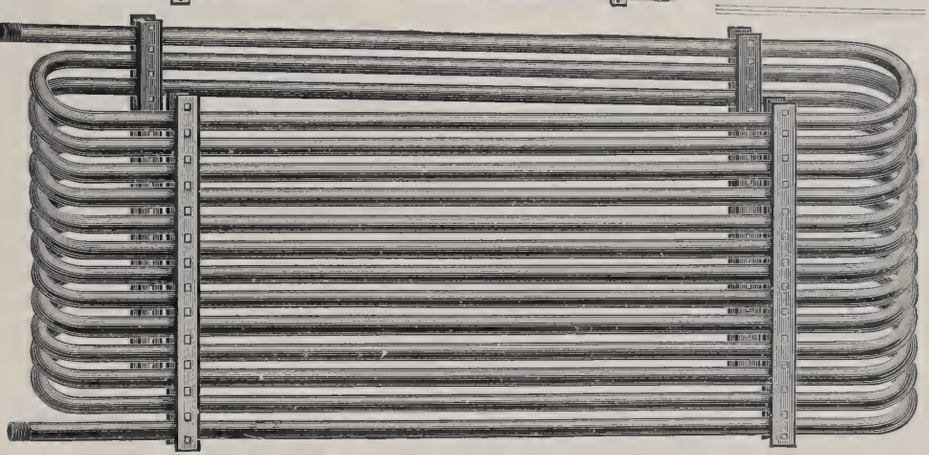
BENDING @

Of Large Sizes Pipe a specialty

SEND FOR CATALOGUE.



Brine and Condenser Tanks, Ammonia Bottles, Ammonia Valves, Flanges, ETC.



JAMES D. CARDELL & CO.

THE ELECTRIC PIPE BENDING COMPANY

OF

HARRISON, N. J.

ARE NOW PREPARED TO FILL ORDERS FOR

SPIRAL COILS,

ZIG-ZAGS, OVALS,

IRREGULAR SHAPES

OF ANY SIZE AND LENGTH

The work is done by the THOMSON ELECTRIC WELDING AND HEATING PROCESSES, thus giving greatly superior results to any of the old methods.

No injury from over-heating. Welds and Bends as sound as the rest of the pipe. All work promptly executed and guaranteed.

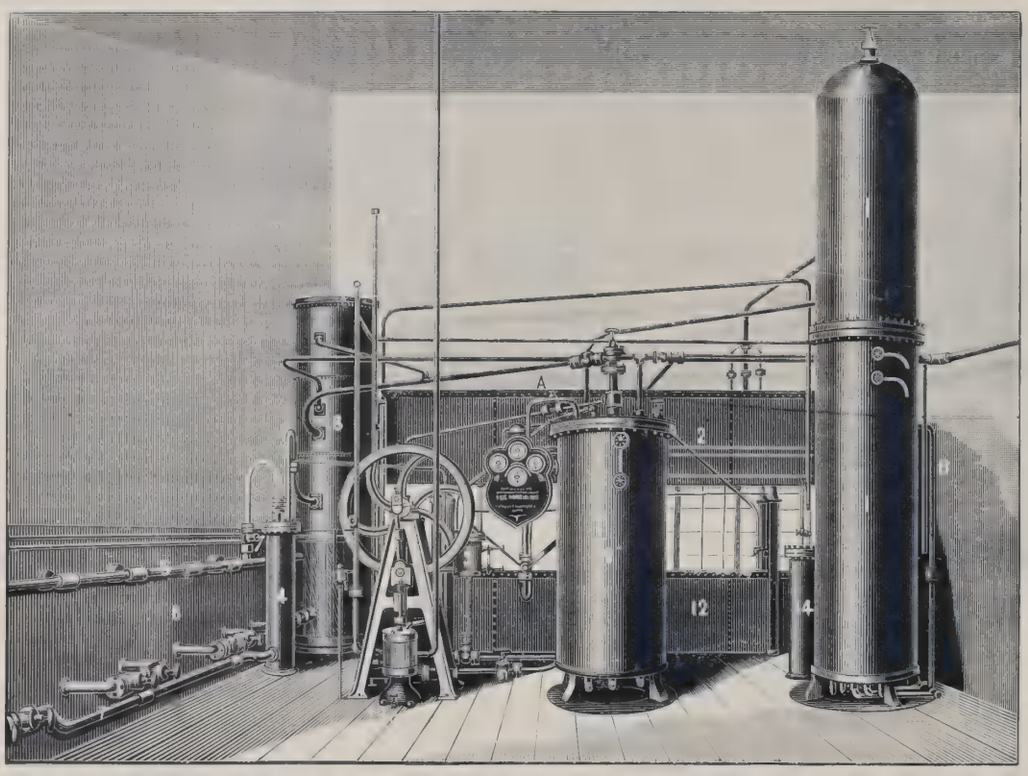
NO BURNT OR DEFECTIVE WELDS.

NO SCALE.

ADDRESS **ELECTRIC PIPE BENDING COMPANY,**

HARRISON, N. J.

COLUMBUS IRON WORKS IMPROVED Absorption Ice Machine



SUCCESSORS TO
H. D. STRATTON & CO.

Established 1853.
Incorporated 1856.

W. R. BROWN, President.
W. COOK, Superintendent.

Machines from 5 to 33 tons capacity per 24 hours, or larger if desired.

94 Machines Built
and all in successful operation

More Ice Making Machines sold in the South than by any other establishment.

No expensive building required. No pressure on machine when stopped.

Send for price list and illustrated circular with location of machines.

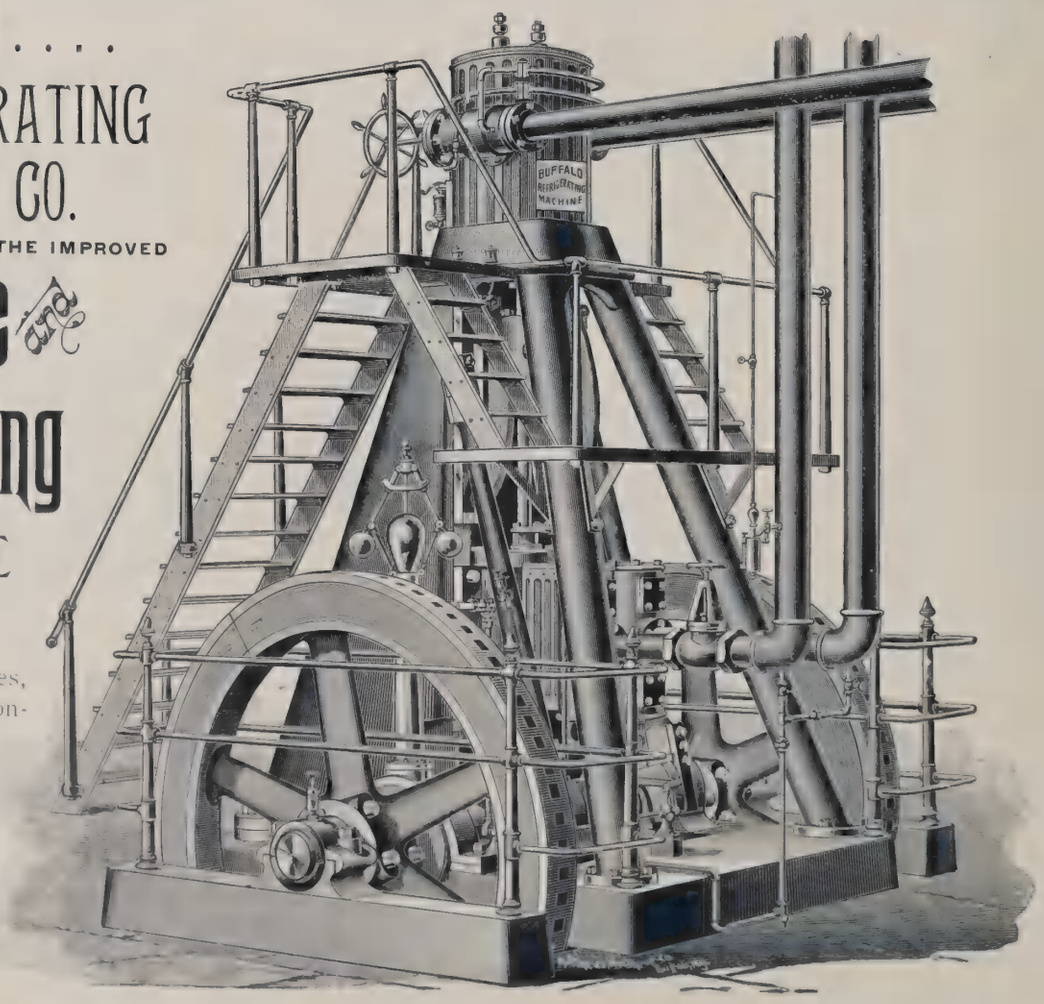
This establishment was the first to turn out a perfect and complete Ice Machine, and has been in the business 21 years, constantly manufacturing and improving, and are prepared to furnish the most reliable and economical machine in the market.

BUILT BY THE . . . **COLUMBUS IRON WORKS CO.** COLUMBUS, GA.

BUFFALO . . . . REFRIGERATING MACHINE CO.

BUILDERS OF THE IMPROVED

Buffalo Ice and Refrigerating MACHINE



Full particulars, estimates, Illustrated Circular, containing list of machines in use, etc., furnished upon application.

Buffalo, N. Y.

The Improved Pontifex-Wood Machine

A MOST ECONOMICAL AND RELIABLE APPARATUS.

Adapted to all classes of Refrigeration, especially where extremely low temperatures are required.

ALSO FOR

MAKING . . . ICE

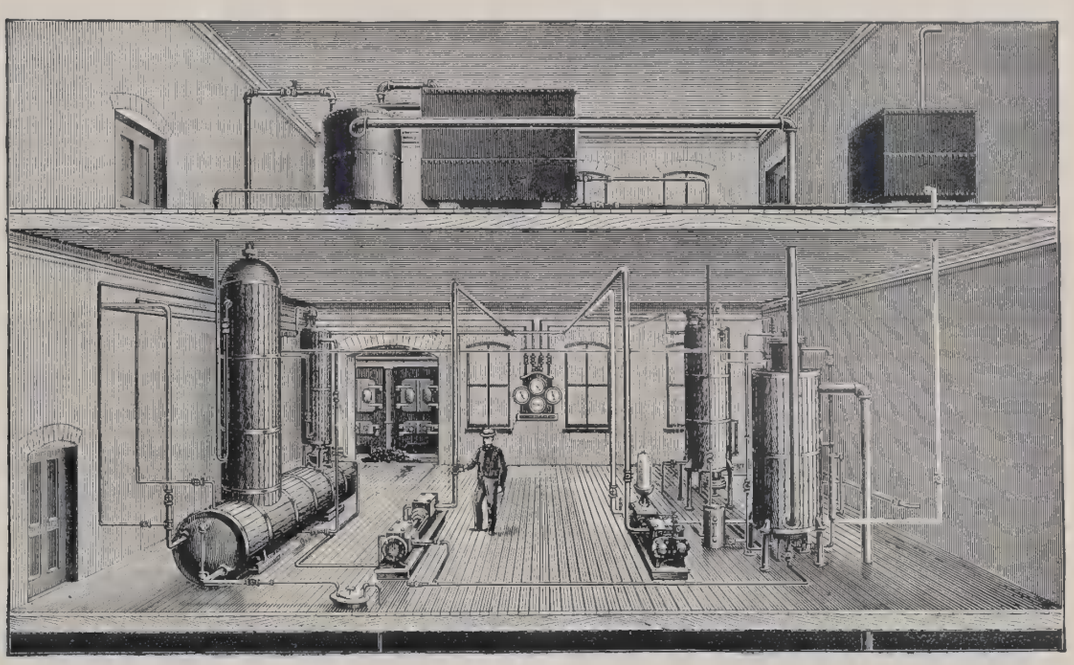
UPWARDS OF

400

MACHINES IN OPERATION.

H. J. W. S. COOKE,
Patentee.

ESTIMATES FURNISHED.
SEND FOR CIRCULARS.



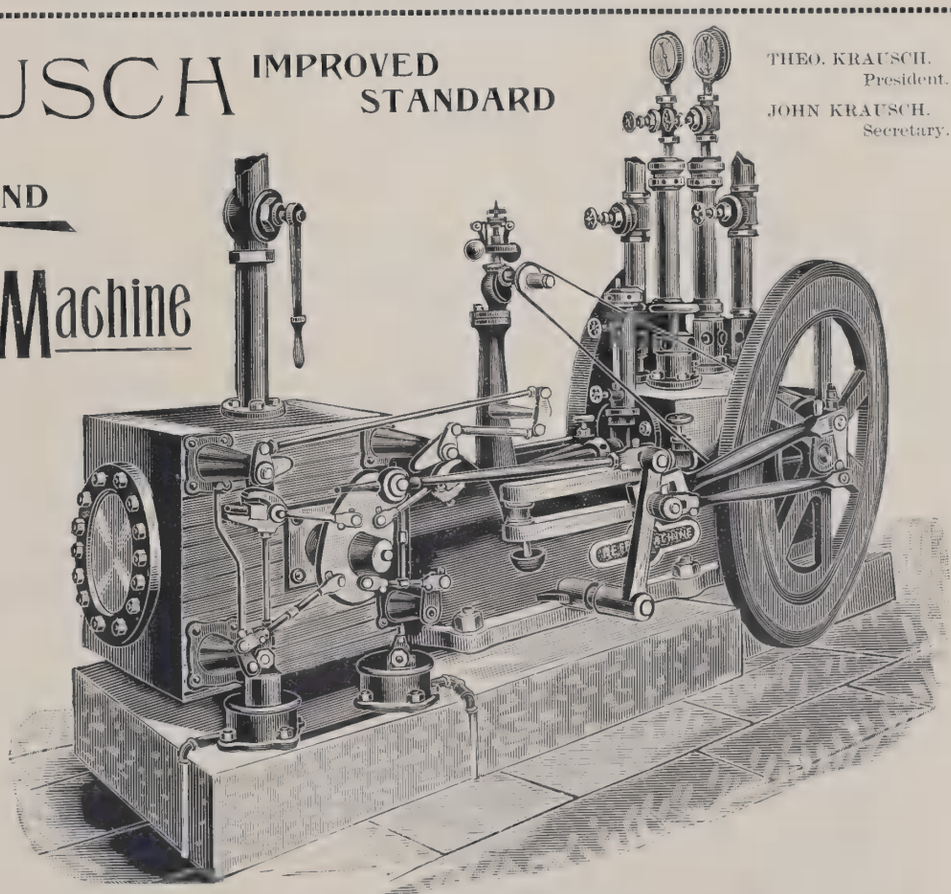
ISBELL-PORTER COMPANY, BUILDERS,

OFFICES

245 BROADWAY, NEW YORK 46 BRIDGE STREET, NEWARK, N. J.

THE KRAUSCH IMPROVED STANDARD ICE AND Refrigeration Machine

THEO. KRAUSCH,
President.
JOHN KRAUSCH,
Secretary.



Is original, horizontal, simple, strong, double acting, central, and is provided with the Corliss Valve Gear. It is most economical in fuel, water and space. Its refrigeration capacity is unsurpassed. Machines are in operation for 10 years without need of repairs, but ordinary wear and tear.

Our machines are guaranteed for years. Plants are erected for Packing Houses, Breweries, Oil Refineries, Cold Storage, Market Houses, Butcher Shops, Hotels and Ice Making.

PRICES ARE MODERATE.

ALL KINDS
ARCHITECTURAL PLANS
FURNISHED.

THE THEO. KRAUSCH CO.

122 E. UTICA STREET, BUFFALO, NEW YORK.

THE PONTIFEX ICE MACHINE COMPANY,

ROBERT HEWITT, President, 512 West Street, NEW YORK CITY,

ARE PREPARED TO CONTRACT FOR

Ice and Refrigerating Plants of any magnitude, under the Reece, Stanley, Pontifex-Wood and Hendrick systems Refrigerant, Aqua Ammonia as constructed under special arrangement with this Company by

THE HENDRICK MANUFACTURING COMPANY, LIMITED, CARBONDALE, PA.

The **PONTIFEX-HENDRICK** Ice and Refrigerating Machine is the result of more than fifteen years' experience in such work on the part of Messrs. Pontifex and Wood, Farrington Works, London, the original builders of the machine in Great Britain and its Colonies, and of the Pontifex Ice Machine Company, American builders, who have somewhat modified the machine to better adapt it for American refrigerating practice. **A Simple, Strong, Durable, Reliable, Economical and Efficient Machine,** particularly adapted for low temperature work, such as the refrigeration of Paraffine Works, Oil Refineries, Freezing and Cold Storage Warehouses, Fish Freezing Houses, Chemical Works, etc. In successful use in **47 Ice Factories** in tropical countries. Over **350** machines in successful operation in Freezing and Cold Storage Warehouses, Breweries, Distilleries, Wineries, Packing Houses, Abattoirs, Dressed Beef Houses and Markets, Dairies and Creameries, Butterine Factories, Yeast Factories, Chocolate and Candy Factories, Hotels and Restaurants, Paraffine and Cotton Seed Oil Refineries, Lard Refineries, Powder and Dynamite Mills. Machines built from **2½** to **100** tons daily refrigerating capacity. Machines guaranteed for material, workmanship and capacity under test. For descriptive circulars, references, detailed specifications, apply either to

THE PONTIFEX ICE MACHINE COMPANY, 512 West Street, NEW YORK.

OR

THE HENDRICK MANUFACTURING CO., Ltd. CARBONDALE, PA.

CASTLE ICE MACHINERY CO.

MANUFACTURERS OF

INDIANAPOLIS, IND.

Absorption Ice and Refrigerating Machines

For all purposes. Containing latest improvements, making REGULAR that which before was NOT regular. Our 15-ton Absorber contains over 6,000 square feet of absorbing surfaces, enabling the temperature of absorption to vary from 50 to 110 deg. Fahr. without affecting operations. One foundation for all machinery. Ice Plant all on one floor. Small water consumption. Economical in operation. Positive and continuous in results. **We guarantee Production and Transparent Ice.** We refer to Seymour Ice Co. (Ind.) having machine with latest improvements.

USING EITHER LIVE OR EXHAUST STEAM, WITH NON-EXPLOSIVE RETORT. AUTOMATIC.

Make your exhaust steam produce silver dollars by using it through our New Designed Machine with improvements for Refrigerating, Cold Storage or Ice Making, from 50 lbs. to 3 tons.

CIRCULARS AND ESTIMATES ON APPLICATION.

THE CASE

REFRIGERATING MACHINE CO.

BUILDERS OF

Ice and Refrigerating Machines

Full particulars, Estimates, Illustrated Circular, containing list of machines in use, etc., furnished upon application.

FOR ICE MAKING AND ARTIFICIAL REFRIGERATING

BUFFALO, N. Y.

JOHNSON, McCARTHY & JOHNSON,

MANUFACTURERS OF

THE JOHNSON COMPOUND

Ammonia Compressor

AND

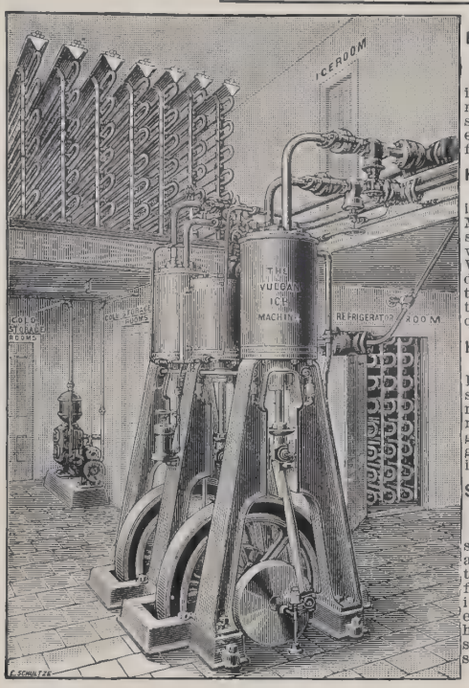
ICE AND REFRIGERATING MACHINES

Office, Room 76, Worcester Block,

PORTLAND, OREGON.

THE VULCAN

Ice and Refrigerating Machine



Enterprise Brewery, San Francisco:
"The 25-ton Refrigerating Machine has been running continuously since 1887, and has proved economical and satisfactory in every respect."

Hotel Del Monte, Mont'y:
"The Ice Machine now in operation at Hotel Del Monte is and has been since its completion a very satisfactory plant. We take pleasure in cordially recommending this variety of machine to any one who may require its use."

Hotel Rafael, San Rafael:
"The 'Vulcan' Ice and Refrigerating plant is satisfactory in every respect, and is doing more work than was guaranteed. A model of good workmanship. The ice is clear."

South San Francisco Packing and Prov. Co.:
"It gives us pleasure to state that the Refrigerating plant furnished by the Vulcan Iron Works for our packing house, in 188[illegible], has been in operation since then, and has given the best results, to our complete satisfaction."

THE VULCAN IRON WORKS,

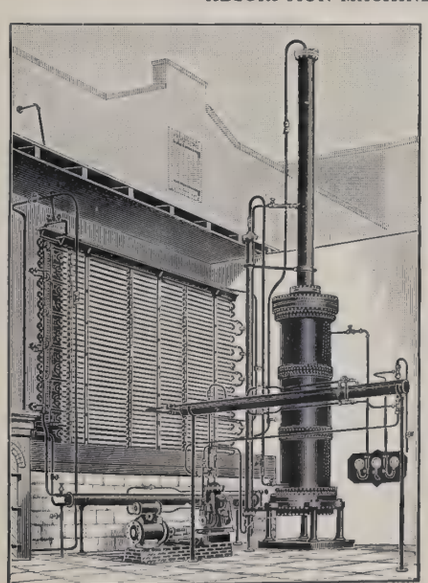
135-145 Fremont Street, **SAN FRANCISCO, CAL.**

PENNSYLVANIA IRON WORKS COMPANY,

.....MANUFACTURERS OF....

Ice AND Refrigerating Machines

EMBODYING THE LATEST IMPROVEMENTS IN ABSORPTION MACHINES.



Ice Machine References

W. H. RAGAN, Thibodaux, La.
HENRY COOK, Donaldsville, La.
GEO. & J. G. MUEHLEBACH, Kansas City, Mo.
LAUER BREWING CO., Reading, Pa.
STEGMAIER & SON, Wilkes Barre, Pa.
J. H. MICHENER & CO., Philadelphia, Pa.
EDSON BROS. Cold Storage, Philadelphia, Pa.
"GLADSTONE" APARTMENTS, Philadelphia, Pa.
THOS. BRADLEY, Cold Storage, Philadelphia, Pa.
FRAISSI & BLUM, Ice Manuf'rs, Houma, La.

AND MANY OTHERS.

SATISFACTION AT LOWEST COST GUARANTEED.

Plans and estimates for plants erected ready for operation cheerfully given on application.

Office and Works, 50th Street and Merion Avenue,

PHILADELPHIA, PA.

NEW YORK OFFICES, 9 AND 11 WALL STREET.

THE CRAFT REFRIGERATING MACHINE CO.

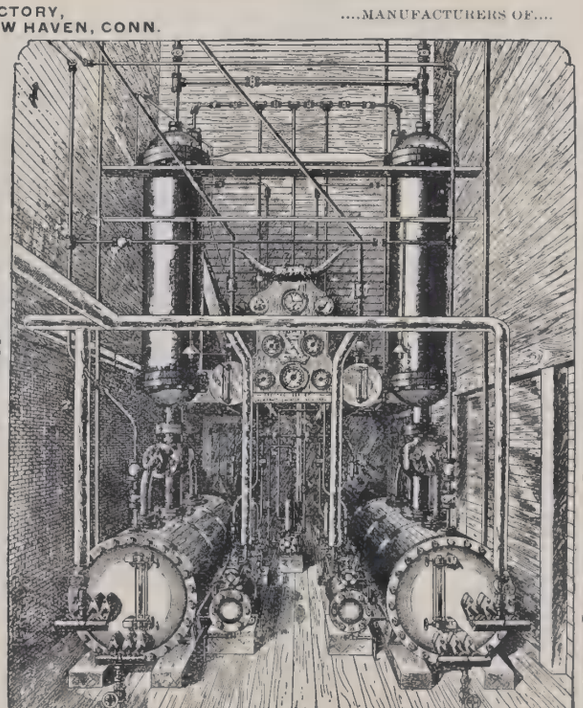
JAMES B. CRAFT, Prest.
H. B. BIGELOW, Treas.
GEORGE S. BARNUM, Sec'y.

No. 15 Cortlandt Street, NEW YORK,

FACTORY, NEW HAVEN, CONN.

....MANUFACTURERS OF....

Descriptive Circulars, References, Detailed Estimates and Information Furnished on Application.



Brewers, Pork Packers, Oil Refiners, Cold Air Store Houses, and all Purposes where a low degree of temperature is required.

ICE AND REFRIGERATING MACHINES

FOR ICE MAKING PLANTS.

THE WESTERN ICE MACHINE CO.

OTTO HOFFMANN, PROPRIETOR.

Ice AND Refrigerating Machinery

FOR BREWERIES, PACKING HOUSES, ICE FACTORIES,
COLD STORAGE PLANTS, MARKETS, CONFECTIONERS, ETC.

Every Part Accessible While in Motion. . . . . .
The Most Cooling with the Least Expense. . . . . .

THIS machine is the simplest, cheapest in first cost and after expense, is more easily handled than any other, and takes less room. Absolutely no possibility of leaking Ammonia. Machines of any capacity from smallest to the largest. We would be pleased to make Estimates, and believe we can show you a saving in cooling your cellars. . . . . .

WESTERN ICE MACHINE CO.

Office, Room 605 Northern Office Building, Cor. La Salle and Lake Sts.,

See this space next issue for Illustration of Machine.

CHICAGO, ILL.

ICE MACHINES

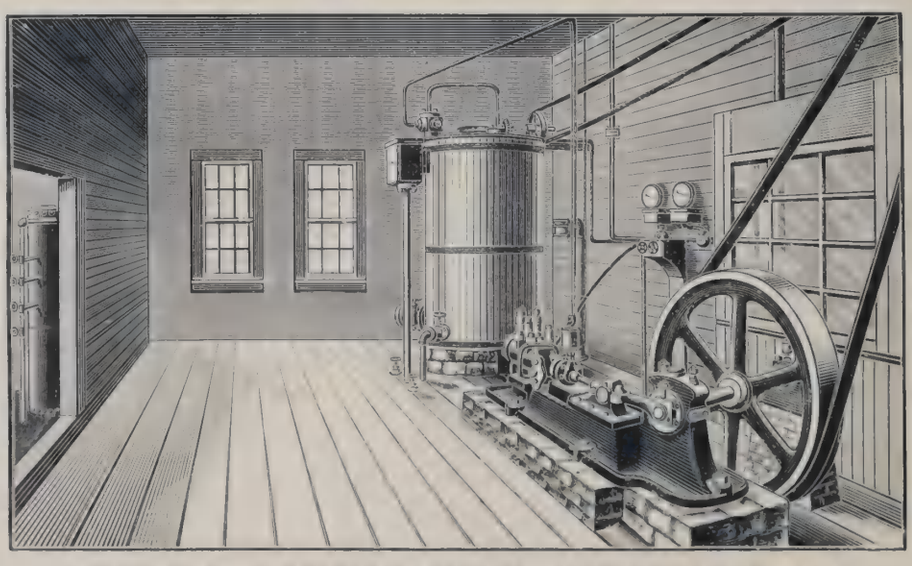
(WINDHAUSEN'S SYSTEM.)

AINSLIE, COCHRAN & CO.

LOUISVILLE, KY.

To the Trade . . . .

We have recently secured the sole right to manufacture and sell WINDHAUSEN'S CARBONIC ANHYDRIDE ICE AND REFRIGERATING MACHINES in the United States. These machines have gained a wide reputation on the continent for their simplicity, durability and economical running. They have been introduced by the German government, an eighty [illegible] ton machine having been placed in the powder works at Spandau. They are also fast superseding other systems in the prominent breweries of Germany, nearly 200 being in operation already. They are the only machines using carbonic anhydride, which has such a great range of expansion, produces such intense cold, and is cheap, odorless and easily obtained



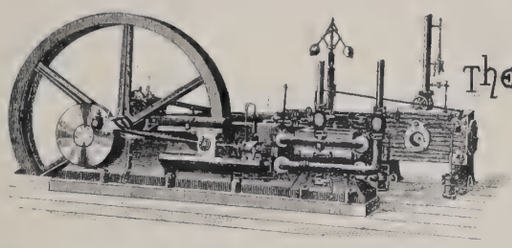
The above cut represents the No. 2 Machine at the Terre Haute House, Terre Haute, Ind.

WRITE TO US FOR FURTHER PARTICULARS

AINSLIE, COCHRAN & CO.

REFRIGERATING PLANTS

THEO. O. VILTER, Pres't & Sup't.
ALBERT WALLBER, Vice Pres't.
WM. O. VILTER, Secy. & Treas.



The Weisel & Vilter Mfg. Co.

Manufacturers of

CORLISS ENGINES,
Machinery for Brewers and Bottlers.

ICE MAKING & REFRIGERATING MACHINERY.

ICE-MAKING PLANTS

FOR BREWERIES, PACKING HOUSES, CONFECTIONERIES, COLD STORAGE HOUSES, ETC.

Direct Expansion or Brine System

MILWAUKEE, WIS.

Van Winkle Gin & Machinery Co.

E. VAN WINKLE, President.
J. WALLACE BOYD, Secretary.

MANUFACTURERS OF

THE KEELING
..AUTOMATIC..
ICE MACHINE

FOR ICE MAKING, COLD STORAGE PLANTS, BREWERIES, PACKERS, ETC.

WRITE FOR ESTIMATES AND FURTHER INFORMATION.

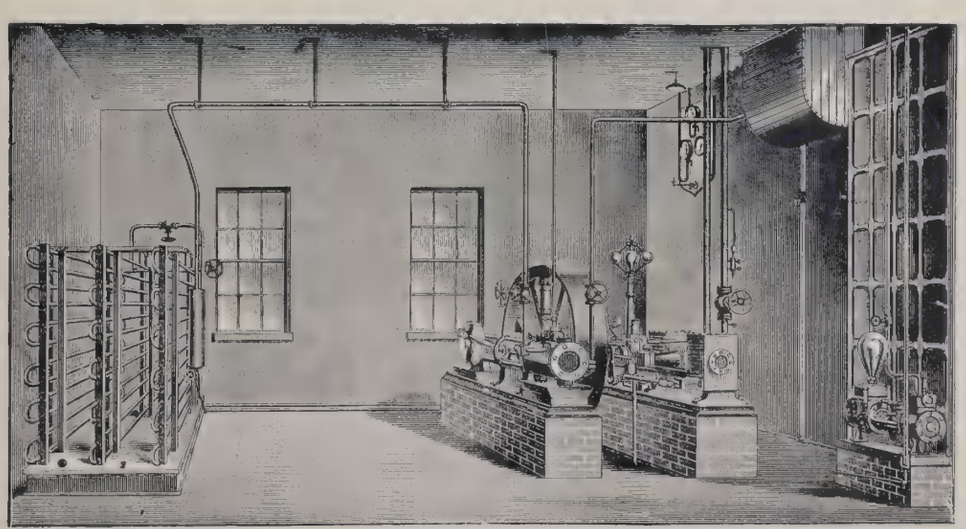
VAN WINKLE GIN AND MACHINERY CO.

OFFICE, 210 MARIETTA STREET, ATLANTA, GA.

The . American . Ice . Machine . Company

SOLE OWNERS OF THE
KLINE AND WINKLER AUTOMATIC

REFRIGERATING AND
ICE MAKING MACHINE SYSTEM



Simplicity of Construction,
Durability, ...
Efficiency, ...
Economy. . . . . .

ICE-MAKING OR
REFRIGERATING
PLANTS

From One Ton to Two Hundred Tons daily capacity.

Over 100 MACHINES IN OPERATION.

1. **The simplicity of construction.** Every part is simple and complete, is exposed to full view, easily got at and can be readily understood and handled by an engineer of ordinary intelligence.

2. **The freezing process is completely automatic** (WHICH NO OTHER FREEZING SYSTEM POSSESSES), through the action of our patent evaporation pressure regulator; it saves valuable working time. Every part is independent of the other, and can be overhauled or replaced without stopping the whole machine.

3. **That ice is manufactured from distilled water,** which is free from disease-producing germs, such as abound in ice frozen on rivers and ponds, is chemically pure, and is infinitely preferable to the natural product.

4. **Our Patent Gas Condenser enables us to work with warmer water and less water** than any other machine, as the water is applied DIRECT on the hot pipe without waste or slop on the surroundings.

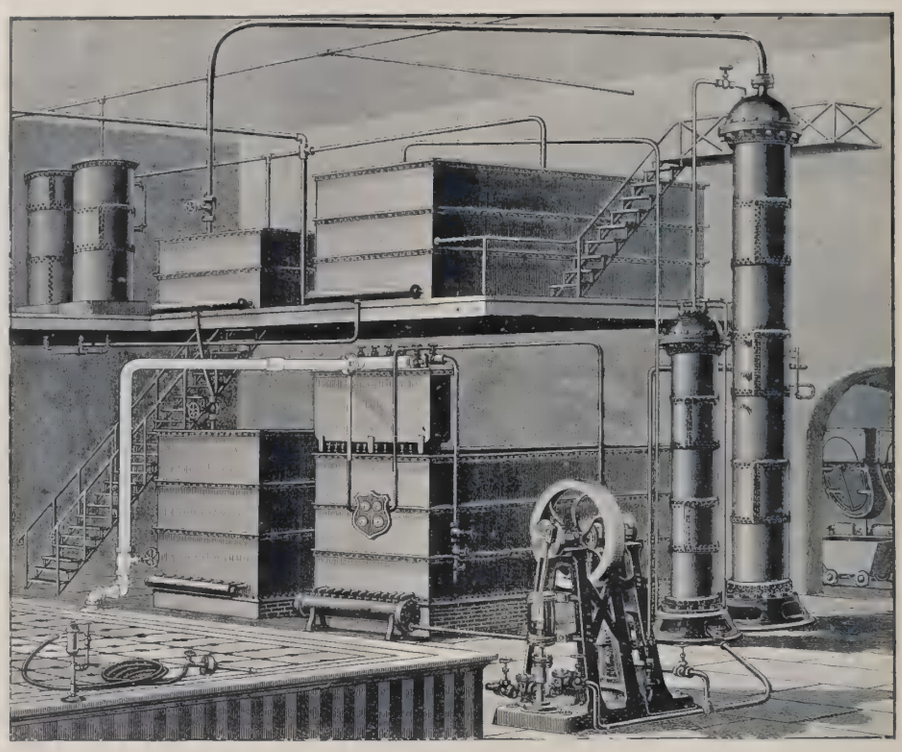
5. **We can make more ice or cold air** than any other machine, WITH THE SAME AMOUNT OF FUEL. Experts have placed the difference in our favor at not less than 25 per cent.

6. **The Condensers and Freezers** will not stop on account of sediment. They never require cleaning. They clean themselves while at work without separate attachment. Our freezing coils are so constructed that no pipe joint is used inside of the tank, and each coil is independent of the other. Each coil section can be taken out while working without interference with the other sections.

Company's Offices, 35 Broadway, Rooms 72, 73, 74 and 75, New York.

Blymyer Ice Machine Company

CINCINNATI
OHIO . . . . .



THE ***ABSORPTION MACHINE*** made by the Blymyer Ice Machine Co. is superior to any compression machine, either for refrigerating or ice making. These machines are ***radically different*** from all other absorption machines, and are in every way superior to them.

BLYMYER ICE-MAKING MACHINES NOW IN OPERATION.

No.	Size.	NAME.	ADDRESS.
1	8 Ton.	Meridian Ice Mfg. Co.	Meridian, Miss.
1	10 "	Baton Rouge Ice Mfg. Co.	Baton Rouge, La.
1	15 "	Evansville Ice and Cold Storage Co	Evansville, Ind.
1	5 "	A. Moresi	Jeanerette, La.
1	15 "	Lookout Ice and Cold Storage Co.	Chattanooga, Tenn.
1	10 "	Morris Ice Co.	Jackson, Miss.
1	15 "	Texarkana Ice Co.	Texarkana, Tex.
1	30 "	Lookout Ice & Cld. Stor. Co.(2d Order)	Chattanooga, Tenn.
1	5 "	Gadsden Ice Co.	Gadsden, Ala.
1	6 "	Sheffield Ice Co	Sheffield, Ala.
1	5 "	Decatur Ice Co	Decatur, Ala.
1	30 "	Crystal Ice Co.	Wichita, Kan.
1	5 "	Denton Ice Co	Denton, Tex.
1	5 "	Van Buren Ice and Coal Co.	Van Buren, Ark.
1	5 "	Biloxi Artesian Ice Mfg. Co.	Biloxi, Miss.
1	25 "	Hutchinson Ice Mfg. Co	Hutchinson, Kan.
1	12 "	Parkersburg Ice Co.	Parkersburg, W.Va.
1	30 "	Union Ice Co.	Denver, Col.
1	3 "	Dominick & Karston.	West Point, Miss.
1	3 "	DeCoppet Ice Co.	Somerset, Ky.
1	35 "	Evansv'le Ice & Cld.Stor.Co.(2d Order	Evansville, Ind.
1	2 "	Van Horn & Chambers	Lebanon, Ohio.
1	4 "	John C. Webb	Demopolis, Ala.
1	12 "	Huntington Ice and Storage Co.	Huntington,W.Va.
1	15 "	Corryville Artificial Ice Co.	Cincinnati, Ohio.
1	3 "	Tupelo Ice Co	Tupelo, Miss.
1	30 "	Wheeling Ice and Storage Co.	Wheeling, W.Va.
*1	10 "	Ft. Payne Ice and Cold Storage Co.	Ft. Payne, Ala.
*1	10 "	Coronado Beach Co. (Hotel del Coronado)	San Diego, Cal.
*1	1 "	Walter Aiken (Hamilton Hotel).	Hamilton, Bermuda
*1	20 "	Decatur Cold Storage and Ice Co.	Decatur, Ill.
*1	12 "	Marietta Ice Co	Marietta, O.
*1	35 "	Dayton Ice Mfg. & Cold Storage Co	Dayton, O.
*1	30 "	Zanesville Artificial Ice Co.	Zanesville, O.
*1	35 "	Evansv'le Ice & Cld.Stor.Co.(3d Order	Evansville, Ind.
*1	3 "	Connolly & Curtis.	Columbus, Miss.
*1	5 "	Lebanon Artificial Ice Co.	Lebanon, Ky.
*1	5 "	Cynthiana Elec. Light & Power Co	Cynthiana, Ky.
*1	5 "	Grenada Cream'y,Cld.Stor.&Ice.Co	Grenada, Miss.
*1	15 "	Washington Ice Co	Washington, Ind.
*1	30 "	Wheeling Ice & Storage Co.(2d Order)	Wheeling, W.Va.
*1	32 "	Consumers Ice Co.	San Francisco, Cal.
*1	15 "	Shelbyville Artificial Ice Co	Shelbyville, Ind.
*1	30 "	Pueblo Distilled Water Ice and Cold Storage Co.	Pueblo Col.

BLYMYER ICE-MAKING MACHINES NOW IN OPERATION.

No.	Size.	NAME.	ADDRESS.
*1	15 Ton.	Skinner & Olson	Topeka, Kan.
*1	35 "	Fort Wayne Artificial Ice Co.	Fort Wayne, Ind.
*1	35 "	Evansv'le Ice & Cd.Stor.Co.(4th Order)	Evansville, Ind.
*1	55 "	Dayton Ice Mfg.&Cd.Sto.Co.(2d Order)	Dayton, O.
*1	15 "	Ashland Artificial Ice Co.	Ashland, Ky.
*1	50 "	Corryville Artificial Ice Co. (2d Order)	Cincinnati, O.
**1	8 "	Gibson House	Cincinnati, O.
**1	10 "	Palace Hotel	San Francisco, Cal.
**1	30 "	The People's Ice Co.	Birmingham, Ala.
**1	35 "	Citizens Ice Co.	Los Angeles, Cal.
**1	20 "	Civill & White	Colorado Spr'gs,Col.
**1	30 "	Pueblo D.W. Ice & Cd.S.Co. (2d Order)	Pueblo, Col.
**1	60 "	Colorado Ice and Storage Co.	Denver, Col.
**1	25 "	E. B. Cornell	Tampa, Fla.
**1	5 "	Mr. H. G. Meumann	Bessemer, Ala.
**1	20 "	Consumers Ice Co.	Vicksburg, Miss.
**1	35 "	Artificial Ice and Storage Co.	Canton, O.
**1	12½ "	Frigid Ice Mfg. Co.	Joplin, Mo.
**1	30 "	Crystal Ice Co.	Albuquerque, N. M.
**1	15 "	Meridian Ice Co. (2d Order)	Meridian, Miss.
**1	5 "	Dayton Ice Co.	Dayton, Tenn.
**1	15 "	Decatur Ice Co. (2d Order)	Decatur, Ala.
**1	12½ "	The Ruddick Artificial Ice Co.	Columbus, Ind.
**1	10 "	Mr. August Erath	New Iberia, La.
**1	55 "	The Crystal Ice Mfg. & Cd. Sto. Co.	Columbus, O.
**1	32 "	Consumers Ice Co. (2d Order).	San Francisco, Cal.
**1	15 "	Peru Ice and Cold Storage Co.	Peru, Ind.
**1	55 "	The Crystal Ice Mfg. and Cd. Stor. Co. (2d Order)	Columbus, O.
**1	32 "	Lafayette Artificial Ice Co.	Lafayette, Ind.
**1	50 "	R. T. McDonald & Judah Hart.	New Orleans, La.
**1	12 "	John Hoey (Hollywood Hotel)	Long Branch, N. J.
**1	15 "	Bridgeport Electric and Ice Co.	Bridgeport, Ala.
**1	5 "	Fleischman & Co.	Cincinnati, O.

* These machines were erected in 1890.
** These machines were erected in season 1891.



BLYMYER REFRIGERATING MACHINES NOW IN OPERATION.

No.	Size.	NAME.	Address.
	Ton		
2	50	Louisiana Brewing Co.	New Orleans.
1	40	Toledo Br'g & Malt'g Co.	Toledo.
1	40	Hudepohl & Kotte Brew'y	Cincinnati.
1	50	Savannah Brewing Co.	Savannah.
1	25	Schantz & Schwind (Br'y	Dayton
1	15	John Smith's Sons (Brew'y)	Youngstown.
1	12	Christ Diehl (Brewery)	Defiance.
1	12	Genessee Oil Works.	Buffalo.
1	12	S. Davis, Jr.,& Co. (Pack'rs)	Cincinnati.
1	50	Occidental Packing & Provision Co.	Lincoln.
1	15	Thos. McFadden, Jr. (Cd. St.	Pittsburgh.
1	15	Grocers' Supply Co. (Cd. St)	Pittsburgh.
*1	40	Adolph Coors (Golden Br'y	Golden.
*1	20	F. Conrad (Brewery)	Anaheim.
*1	25	The Sachs-Prudens Ale Co.	Dayton.

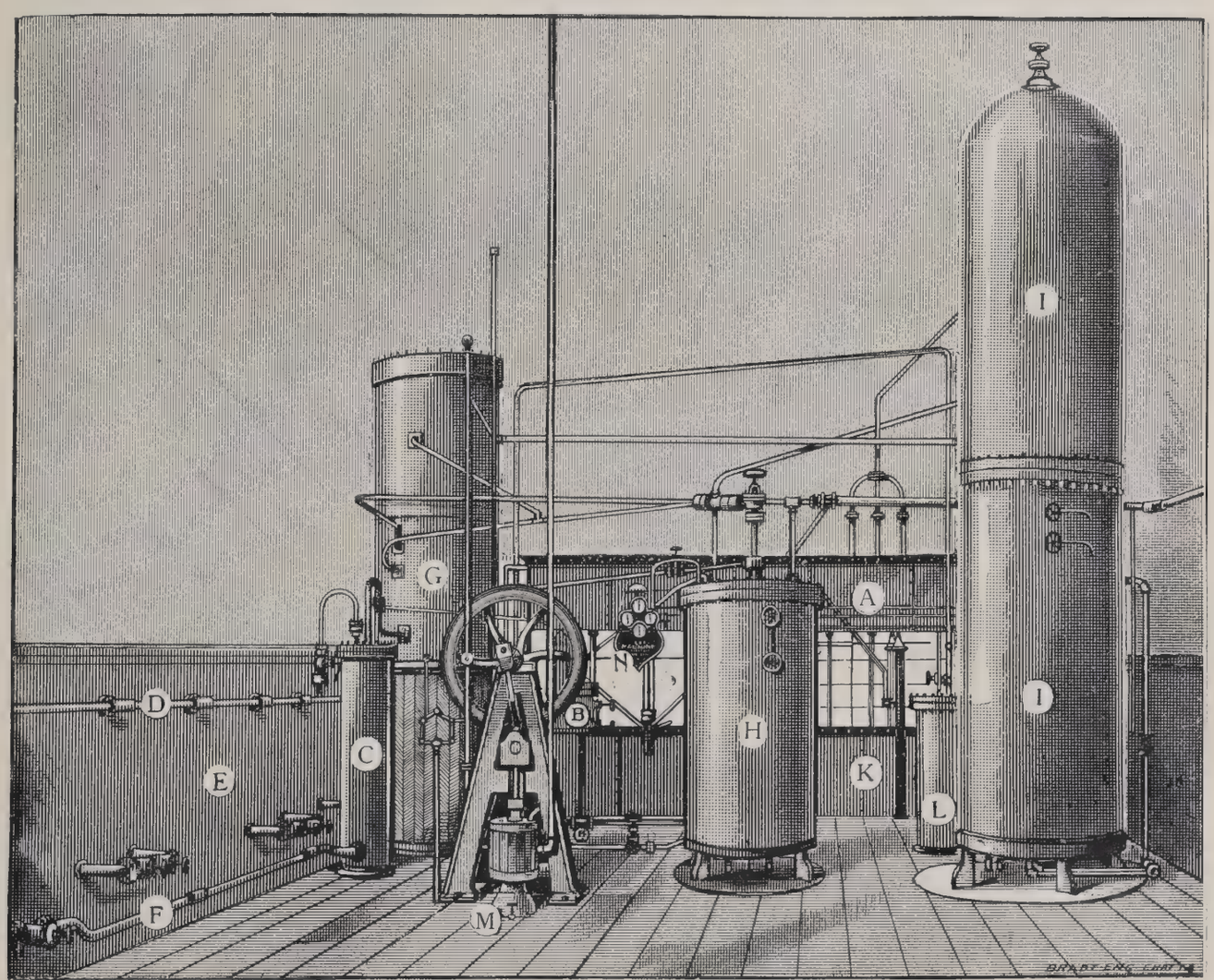
* These machines were erected in 1890.

SOUTHERN ICE MACHINE CO.

SOLE OWNERS AND MANUFACTURERS OF

· · · The Latest Improved Absorption · · ·

ICE AND REFRIGERATING MACHINE.



.·. THE SOUTHERN .·.

The SOUTHERN ICE AND REFRIGERATING MACHINE is one of the best and has been acknowledged by the most experienced ice manufacturers to work more economical and produce ice cheaper and of a better quality than any other machine on the market to-day.

ALL MACHINES NOW IN OPERATION ARE GIVING PERFECT SATISFACTION.

FOR ESTIMATES AND FURTHER PARTICULARS ADDRESS THE . . . .

SOUTHERN ICE MACHINE CO.

CHATTANOOGA, TENN.

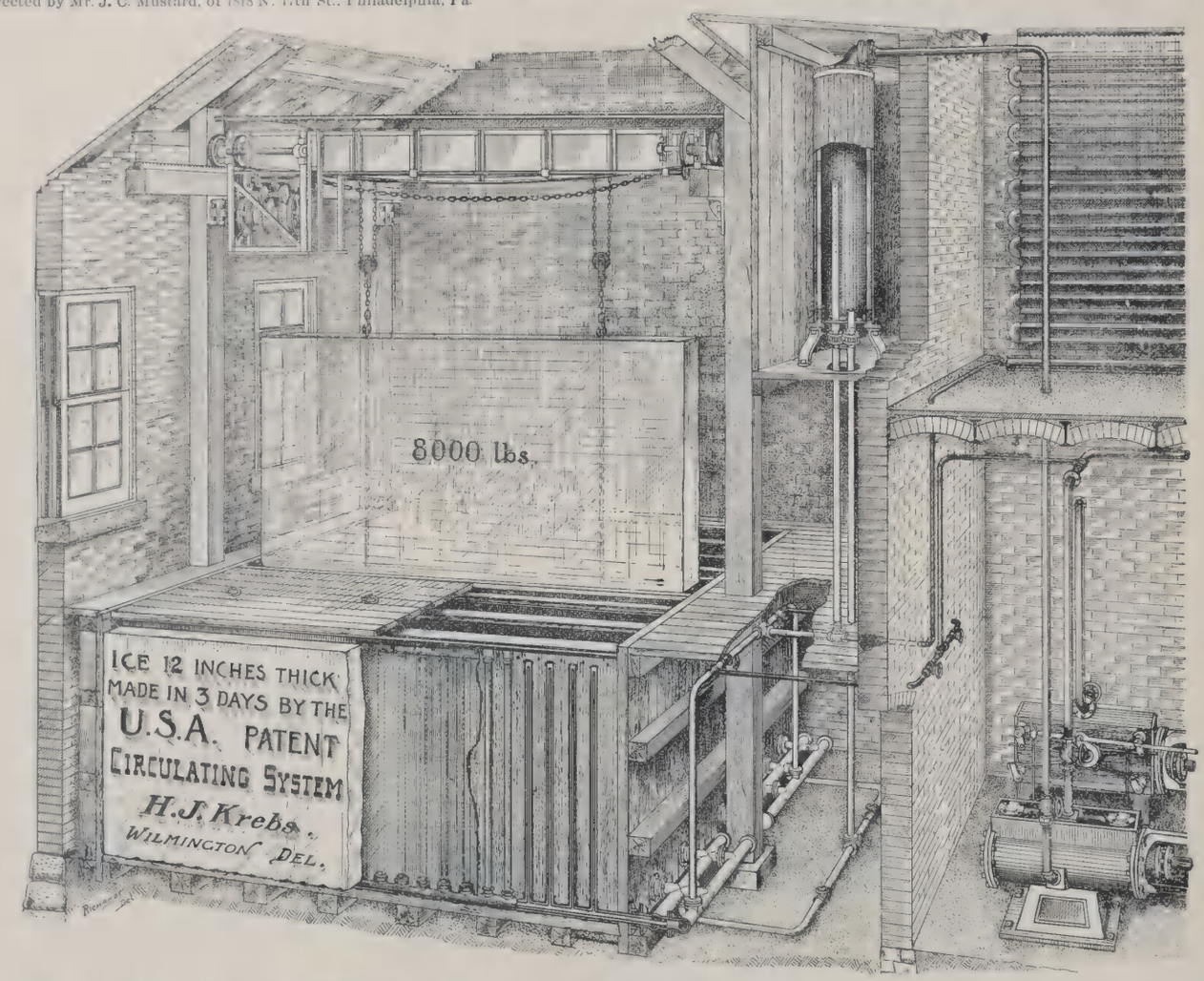
H. J. KREBS' U. S. A. Circulating System of Ammonia

PATENTED SEPTEMBER 9, 1890.

The results achieved by this system, both for brine cooling and ice making, are unexcelled. It ensures dry gas to the pump and abundance of feed to the expansion pipes, therefore economy in piping, economy in ammonia and economy in space. It is simple and easily operated, and saves time, money and worry.

IN ORDERING MACHINES SPECIFY THE U. S. A. CIRCULATING SYSTEM.

During last year it was introduced with great success in the following establishments: Charles W. Street, Packing House, Baltimore, Md.; Washington Abattoir Co., Bennings, D. C.; New Abattoir, Philadelphia Stock Yards, Philadelphia, Pa.; Wilmington Abattoir and Cold Storage Co., Wilmington, Del. These plants were erected by Mr. J. C. Mustard, of 1818 N. 17th St., Philadelphia, Pa.



This system is suitable for all makes of Compression Machines. It secures ample feed to the expansion pipes and a regular flow of dry gas to the compressors, which thereby are enabled to do more and better work.

SOME OF THE ADVANTAGES ARE: Reduced number of valves, reduced pipe surface, reduced first cost, reduced consumption of ammonia, reduced attendance, reduced space, reduced wear and tear, reduced bills, increased refrigerating effect, increased certainty of operation, increased life of machinery, increased satisfaction, increased balance sheet. For full particulars address

H. J. KREBS, M. E., WLMINGTON, DEL.

J. C. MUSTARD,

1818 North 17th Street, Philadelphia, Pa.

BUILDER OF

ICE MAKING AND REFRIGERATING MACHINES

DURING LAST YEAR I HAVE ERECTED THE FOLLOWING PLANTS:

∴ REFRIGERATING . MACHINES ∴

N. Antle, Pork Packer,	Washington, D. C.	Big Elk Dairy,	Oxford, Pa.
C. Spuck, Sausage Maker,	Baltimore, Md.	West Chester Dairy,	West Chester, Pa.
David Eichner, Pork Packer,	Baltimore, Md.	Chas. W. Street, Packing House,	Baltimore, Md.
J. F. C. Hausen, Pork Packer,	Baltimore, Md.	Washington Abattoir Co.,	Bennings, D. C.
Jos. J. Martin, Brandywine Dairies,	Cossart, Pa.	Wilmington Abattoir and Cold Storage Co.,	Wilmington, Del.
R. W. Downing, Wallingford Dairy,	Wallingford, Pa.	New Abattoir, Philadelphia Stock Yards,	Philadelphia, Pa.
H. B. & E. A. Pugh, Dairy,	Oxford, Pa.		

∴ ICE . PLANTS ∴

J. S. Bell & Sons, Ice Factory,	Norfolk, Va.	Suffolk Ice Co.,	Suffolk, Va

The last named plant I am now about starting, having changed it from absorption to compression. A number of above plants are fitted with the U. S. A. Circulating System, which for efficiency, economy and simplicity cannot be surpassed. My long experience in the ice and refrigerating trade enables me to select the best, and I take especial pride in furnishing high grade machinery at moderate cost.

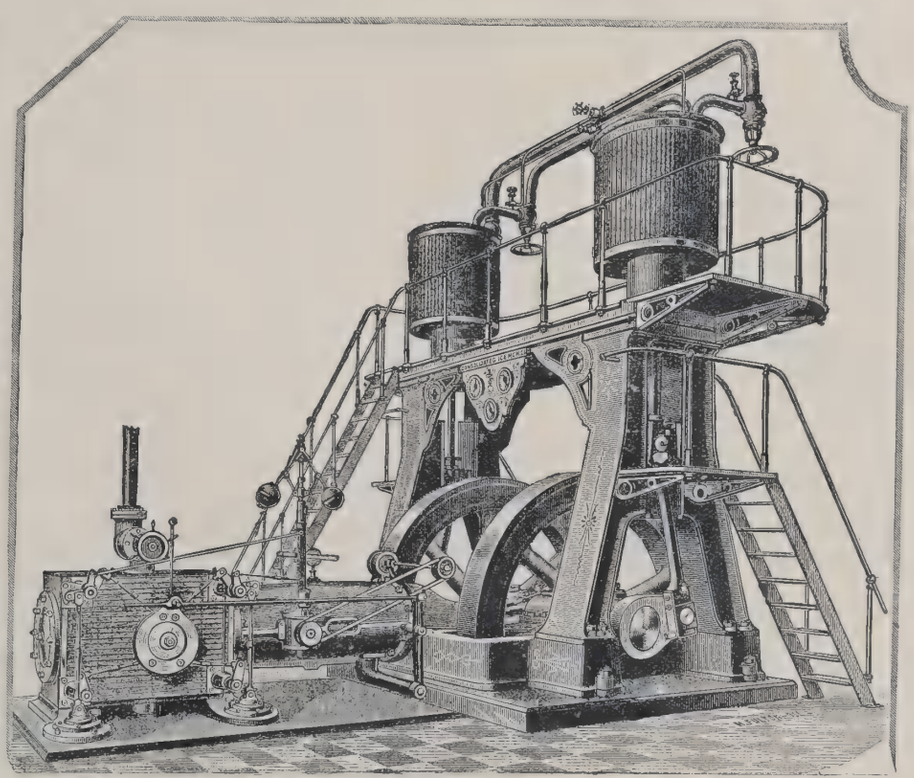
J. C. MUSTARD,

1818 North 17th St., Philadelphia, Pa.

CORRESPONDENCE SOLICITED.



CONSOLIDATED ICE MACHINES



FOR several years past we have been engaged in building Consolidated Ice Machines, and many of the very best running in the United States, at the present time, are of our manufacture. Since the original Company have failed, we have concluded to continue this business, and hereafter will manufacture, to order, any kind or style of a Consolidated Ice Machine desired. We will also contract for complete plants, and will put in either direct or brine circulation, as may be desired. We make a specialty of furnishing duplicate parts, and keep them always in stock, and can furnish on short orders any detail of these machines. We manufacture special steel valves and white metal rings designed especially for ammonia work.

We guarantee protection against any and all claims or pretended claims for patents on these machines.

These machines are known throughout the United States for the excellence of their construction, and their superiority to all others in use. They need no better recommendation than their own work. All the material and workmanship on them is of the finest quality. We have the original drawings and patterns in our possession, and can furnish a better machine for less money than can be built elsewhere. We also manufacture and keep on hand to supply the trade the finest steel fittings and steel valves made in the world, designed especially for ammonia work, and will be pleased to quote prices to purchasers.

NOTE.—It has come to our knowledge that parties owning or claiming to own a bogus patent, issued to one James Boyle in 1876, for an ammonia compressor, have been putting in circulation notices that the pumps used on the Consolidated Refrigerating Machines is an infringement on said patent, and that they will bring suit against any one using them; therefore we hereby guarantee to all persons purchasing one of our machines protection against said fraudulent claims, and request all persons receiving one of such notices to forward the same to us, with a statement setting forth whether they have been influenced not to buy a Consolidated Machine thereby. We also give the parties setting up these claims public notice that we will bring suit against them for damage to our business by them, by misrepresentation and fraud.

JOHN FEATHERSTONE'S SONS,

2-36 Front Street, Corner North Halsted,

CHICAGO.

THE DE LA VERGNE REFRIGERATING MACHINE CO.

MANUFACTURERS OF

Foot of East 138th Street (Port Morris.)

NEW YORK, U. S. A.

REFRIGERATING AND ICE MACHINES AND ANHYDROUS AMMONIA . . . .

Over

360

Machines are now in Successful Operation, Representing a Total Capacity Equal to the Melting of over

18.000

Tons of Ice Per day.



Machines are used for the Cooling of

Breweries, Abattoirs and Packing Houses, Markets and Cold Storage, Hotels and Restaurants, Chemical Works, Confectioneries, and Chocolate Manufactories, Steamship Holds, Wineries, Dairies,

AND FOR THE MANUFACTURE OF **ICE**

A FULL DESCRIPTION OF OUR SYSTEM AND APPARATUS WILL BE SENT TO PERSONS APPLYING FOR THE SAME.

CORRESPONDENCE FROM PARTIES DESIROUS OF CONTRACTING FOR PLANS IS SOLICITED.

Estimates and Proposals will be promptly furnished free of charge as soon as the requirements are made known to us.

PICTET

Ice and Refrigerating Machine

....MANUFACTURED BY....

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

WE DO NOT USE AMMONIA.

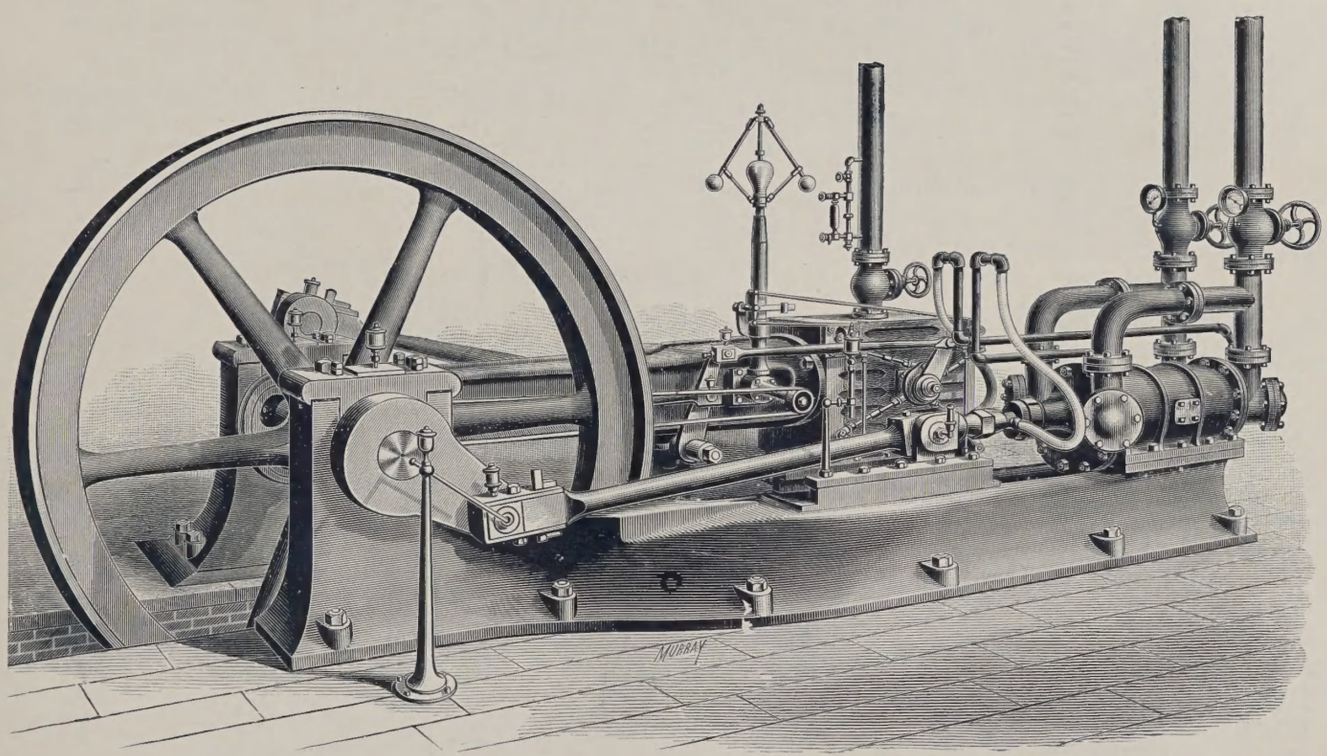
Pictet Machines use **Anhydrous Sulphurous Oxide,** a chemical noted for its low working pressure, is of itself a lubricant, and does not injure any of the metals; its low pressure is a guarantee against explosion.

NEW YORK BOARD OF FIRE UNDERWRITERS,
BUREAU OF SURVEYS
JAMES HARRISON, Supt.
Boreel Building, 115 Broadway, Room 37.

NEW YORK, January 24, 1891.

THE PICTET ARTIFICIAL ICE CO. (Limited), New York:

Dear Sirs: Your favor of the 22d inst. is at hand. In reply, the examination of our expert and his subsequent report were convincing that the article known as Anhydrous Sulphurous Oxide is a safe article for storage or shipment, its tendency being to extinguish rather than to cause fire. Yours truly, JAMES HARRISON, Supt.



Working Pressure from 50 to 75 lbs.

We guarantee GREATER ECONOMY OF FUEL, doing the same amount of work with less coal than any machine in the market.

FOR LIST OF REFERENCES AND FURTHER PARTICULARS, ADDRESS

WHITEHILL ENGINE AND PICTET ICE MACHINE CO.

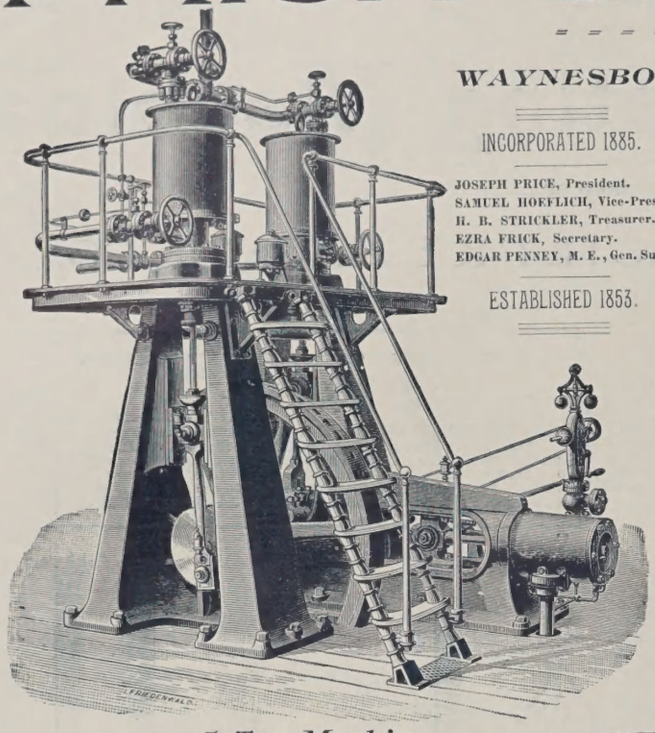
WORKS: NEWBURGH, N. Y.

New York Office, 21 Cortlandt St., Room 6.

FRICK COMPANY

ENGINEERS,

WAYNESBORO, FRANKLIN COUNTY, PA., U. S. A.

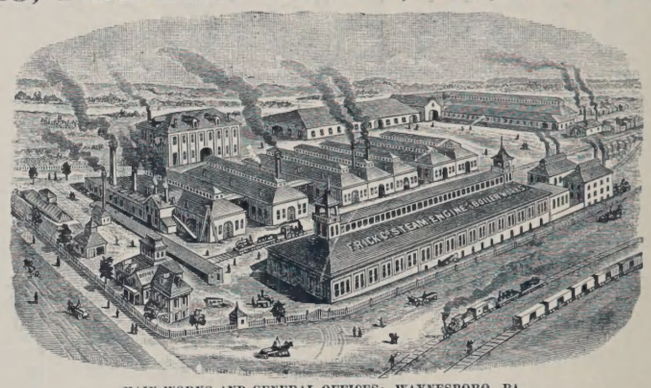


5-Ton Machine.

INCORPORATED 1885.

JOSEPH PRICE, President.
SAMUEL HOFFLICH, Vice-Pres.
H. B. STRICKLER, Treasurer.
EZRA FRICK, Secretary.
EDGAR PENNEY, M. E., Gen. Sup.

ESTABLISHED 1853.



MAIN WORKS AND GENERAL OFFICES: WAYNESBORO, PA.

CAPITAL, - - - - - - $1,000,000.

MANUFACTURERS OF THE

ECLIPSE

Ice Making AND Refrigerating Machines.

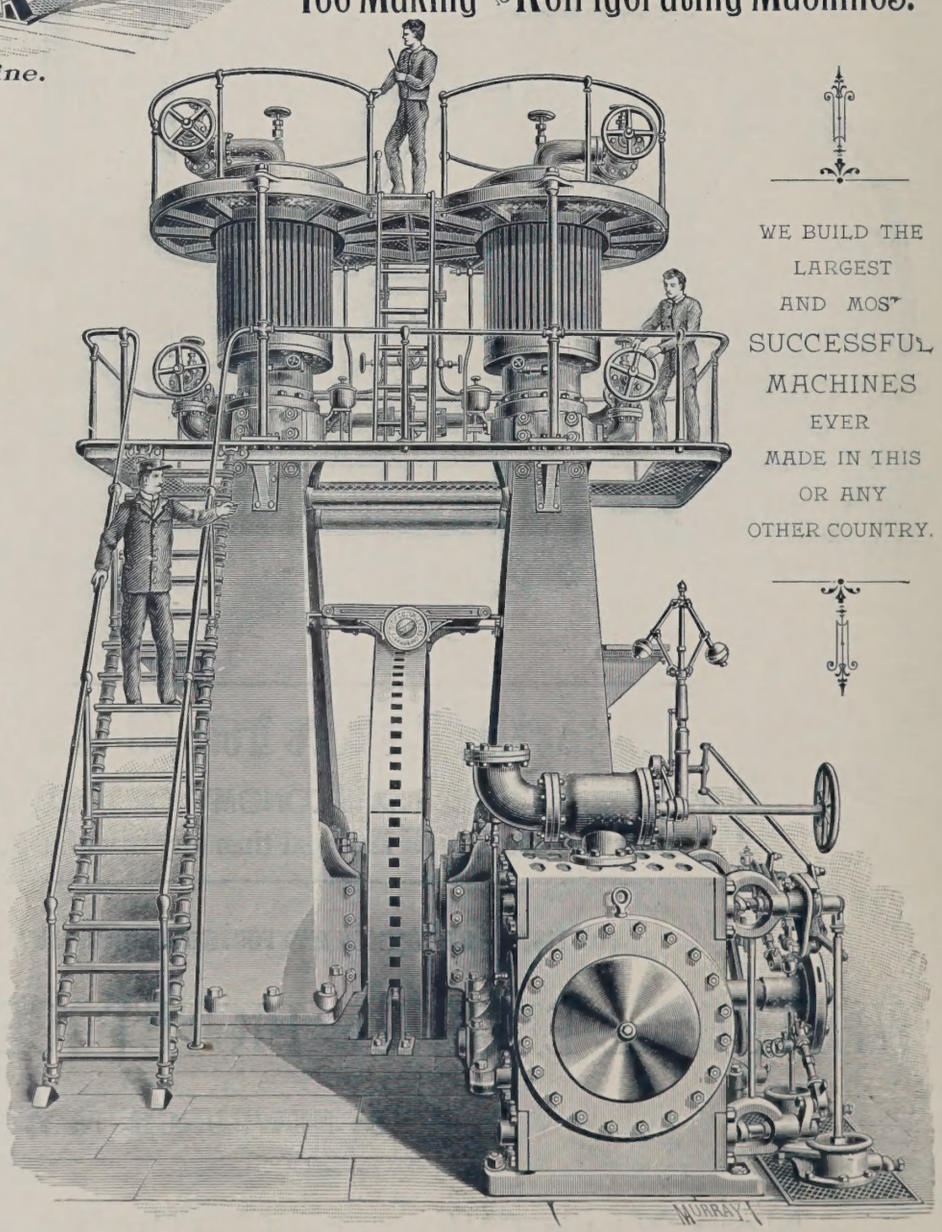
SEND FOR OUR NEW CATALOGUE, 1890.

A Few References:

BREWERIES.	Refrigerating Tons.
Phoenix Brg. Co., Baltimore, Md.	27
Gipps Brg. Co., Peoria, Ill.	50
Sprattler & Mennell, Paterson, N. J.	32
Herman Lackman, Cincinnati.	65
Henry Fink, Harrisburg, Pa.	32
Sebastian Helldorfer, Baltimore, Md.	32
Frank Reisch & Bros., Springfie'd, Ill.	50
Jos. Stein & Co., Louisville, Ky.	23
Meyer & Reidlin, Covington, Ky.	32
Parkersburg Brg. Co., Parkersburg, W. Va.	27
Bellevue Brg. Co., Cincinnati, O.	50
Cumberland Brg. Co., Cumberland, Md.	27
D. Lutz & Son, Allegheny, Pa.	50
Herman Lackman, Cincinnati (2d order)	80

PACKING AND COLD STORAGE.	
J. C. Shafer & Co., Baltimore	40
G. Cassard & Sons, Baltimore	25
Baltimore City Storage Co., Baltimore	32
Armour Packing Co., Kansas City	100
Shallcross & Son, Coatesville, Pa.	15
Washington Market Co., Washington, D. C.	32
Armour Pckg. Co., Kansas City (2d order)	150
Francis Whittaker & Sons, Wichita, Kas.	150
Emil Winters, Pittsburgh, Pa.	37
Frank Seifrid, Louisville, Ky.	7
Chicago Packing & Provision Co., Chicago	150
Chicago Packing & Provision Co., Chicago (second order)	150
Steelton Store Co., Steelton, Pa.	10
Pittsb'gh Meat Supply Co., Allegheny, Pa.	50
J. Vogle & Son, Cincinnati.	50
John C. Hately, Chicago	65
G. H. Hammond & Co., Hammond, Ind.	150
G. H. Hammond & Co., Omaha, Neb.	150
Calumet Canning Co., Hammond, Ind.	32
West Chester Cd. Stor. Co., W. Chester, Pa.	40
Chautauqua Lake Ice Co., Pittsburgh, Pa.	20

ICE FACTORIES.	Ice. Tons.
F. L. Ellis & Co., Hopkinsville, Ky.	10
Consumer Ice Co., New Orleans, La.	100
Little Rock Ice Co., Little Rock, Ark.	35
Owensboro Ice & Cd. Stor. Co., O'sb'o, Ky	20
W. S. Lurton, Jacksonville, Ill.	15
Pulaski Ice Co., Pulaski, Tenn.	5
Armour Packing Co., Kansas City	75
Ewing & Beall, Uniontown, Pa.	15
S. W. Hill, Allegheny, Pa.	18
Chautauqua Lake Ice Co., Pittsburgh.	40
Chautauqua Lake Ice Co., Pittsburgh (2d order)	40
West Chester Ice Co., West Chester, Pa.	15
Steelton Store Co., Steelton, Pa.	2
Parkersburg Brg. Co., Parkersburg, W. Va.	3
Cumberland Brg. Co., Cumberland, Md.	8
Hagerstown Ice Co., Hagerstown, Md.	20
Alberto Malo, City of Mexico, Mex.	25
Germantown Ice Co., Germantown, Pa.	20
Bryn Mawr Hotel Co., Bryn Mawr, Pa.	20
Geo. S. Sexton & Co., Wytheville, Va.	5
Cambridge Ice Co., Cambridge, Md.	10

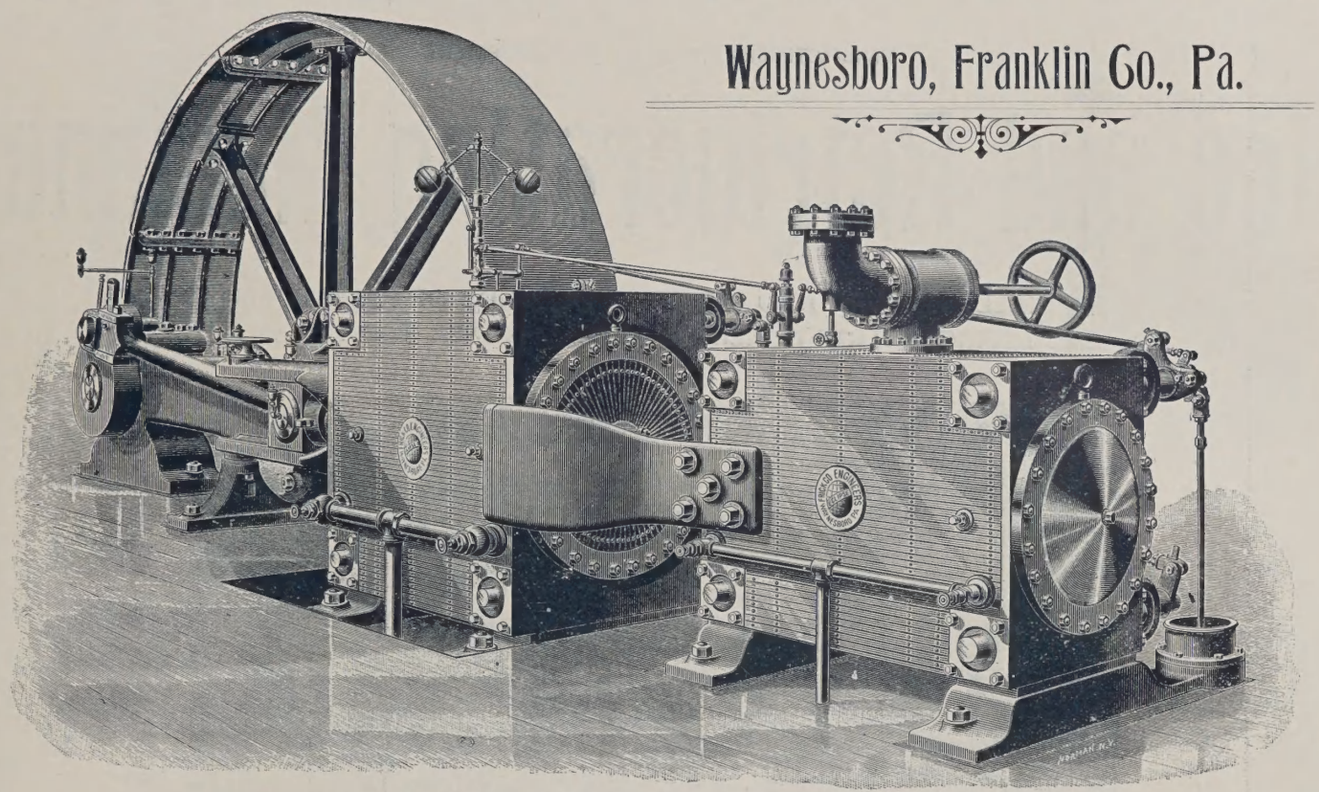


150-Ton Machine. Weight, 193,250 Pounds.

WE BUILD THE LARGEST AND MOST SUCCESSFUL MACHINES EVER MADE IN THIS OR ANY OTHER COUNTRY.

FRICK COMPANY, ENGINEERS,

Waynesboro, Franklin Co., Pa.



A GENUINE CORLISS ENGINE WITH ALL THE LATEST IMPROVEMENTS.

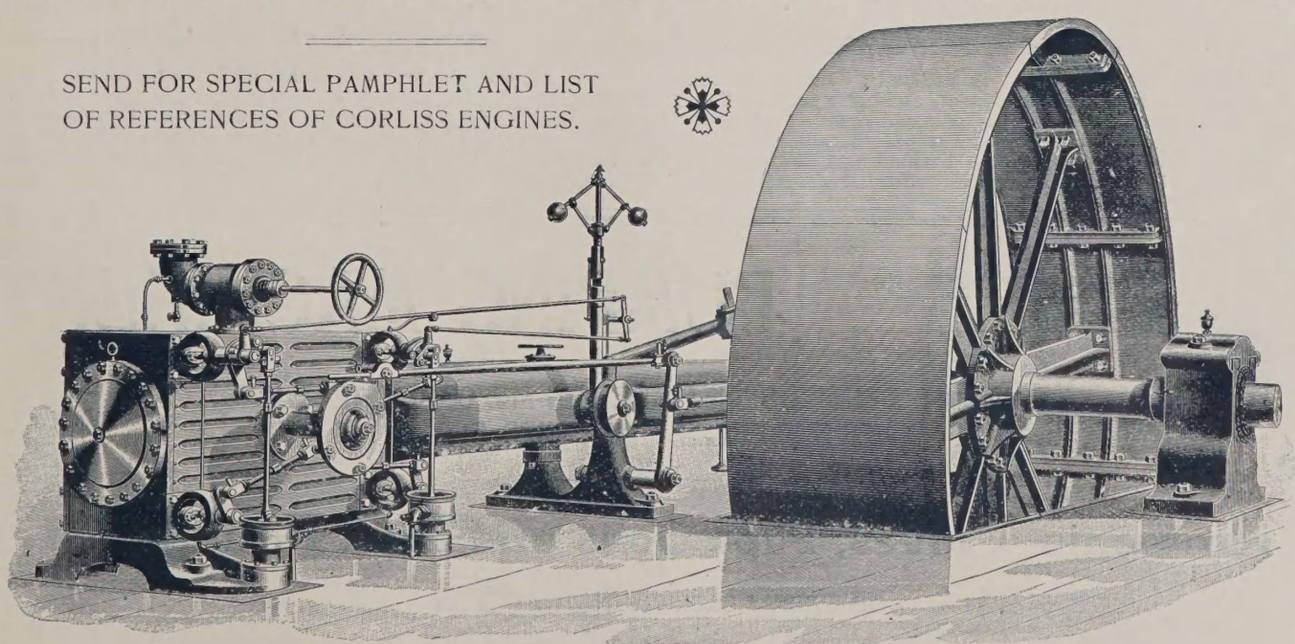
"EGLIPSE" CORLISS TANDEM COMPOUND CONDENSING ENGINE

UP TO 3000 HORSE POWER

We have complete line of patterns and build Corliss Horizontal Stationary Engines, Corliss Vertical Engines, Condensing or Non-Condensing, Single or in Pairs. Corliss Compound Engines, Tandem or Cross Compound. Corliss Engines for any service, 40 to 3000 horse power, in a single engine.

SPECIAL NOTICE.—With our Corliss Engine we contract for fitting up complete the entire Steam Plants, including Steam Boiler, Feed Water Heater, Feed Pumps, Piping, Shafting, and all the appurtenances and belongings peculiar to a first-class job.

SEND FOR SPECIAL PAMPHLET AND LIST OF REFERENCES OF CORLISS ENGINES.



1000 HORSE POWER "EGLIPSE" PLAIN CORLISS ENGINE.

THE WILSON-SNYDER MFG. CO.

MANUFACTURERS OF AUGUST SNYDER'S PATENT

Ice and Refrigerating Machine

SPECIALLY DESIGNED TO MEET THE DEMANDS OF ICE MAKERS AND REFRIGERATION IN ALL ITS APPLICATIONS . . . . . .



INTERIOR VIEW OF WORKS OF THE WILSON-SNYDER MFG. CO.

TWO styles of these machines are built: One, single acting compressor, with duplex condensers and brine tanks; the other, duplex compressor, condensers and brine tanks. The special advantages of this machine over all others are as follows: In either the single or duplex machine, either one of the brine tanks or condensers getting out of order, or anything happening to necessitate repair, the system of valves is so arranged as to allow using but one condenser or one brine tank, and the machine is kept running with the disabled part as though nothing had happened, while the disabled brine tank or condenser is being dismantled and repaired. Write for list of machines in operation, references, prices, etc. . . . . .

ALSO MANUFACTURERS OF IMPROVED . . . .

PUMPING MACHINERY

Including AIR PUMPS, BRINE PUMPS, HOT AND COLD WATER PUMPS, BOILER FEED PUMPS, TANK PUMPS, Etc.

Ammonia Valves, Pipe Coils and Pipe Fittings

.....OF EVERY DESCRIPTION.....

PITTSBURGH, PA.